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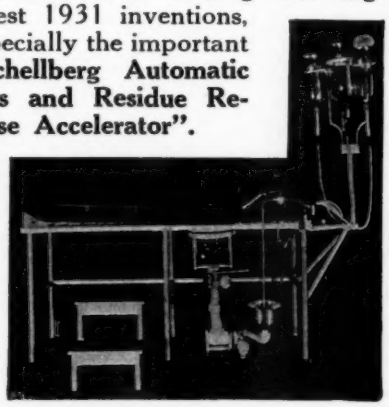

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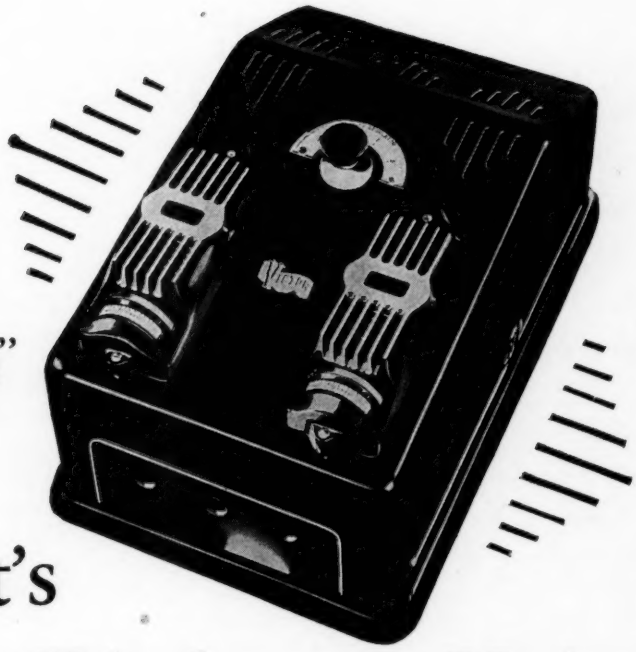

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SUNLIGHT, NUTRITION AND METABOLISM *

II. The Sun-Deficiency Diseases in Relation to Climate, Industry, Distribution of Population, Custom and Habit

VICTOR E. LEVINE, Ph.D., M.D.

Department of Biological Chemistry and Nutrition, School of Medicine, Creighton University

OMAHA, NEBRASKA

The sun-deficiency diseases, rickets, tetany and osteomalacia, may be regarded essentially as climatic disorders. Palm as early as 1890, as a result of a statistical study of the geographical distribution of rickets throughout the world, from Siberia to Africa, came to the conclusion that the disorder developed because of lack of sunlight. He noted that the disease was prevalent in sections of the world where there was comparatively little sunshine, and that it was rare where there was a relative abundance of sunshine. He recommended the systemic use of sunbaths as a preventive and therapeutic procedure for rickets. A map of the incidence of rickets is the practical equivalent of a map indicating deficiencies of sunlight. A table listing the number of sunshine hours per year in each community would present the geographical distribution of rickets throughout the world, provided all other factors were the same. These other factors include the intensity and quality of the ultraviolet rays reaching the earth as influenced by latitude, altitude and distribution of dust and vapor particles, and the extent of out-door living as influenced by industrial conditions, by racial or national custom and by personal habit.

Other things being equal, we may state that communities having the same number of sunshine hours during the year should show the same frequency for rickets. Communities blessed with the greatest number of sunshine hours should enjoy the least incidence of rickets, while those having the least number of sunshine hours should display the greatest incidence. Table I gives the annual sunshine hours of important places in various parts of the globe as given by A. F. Hess, but rearranged in ascending order.

Rickets occurs with equal frequency in New Orleans, Washington, D. C., and New York. The amount of sunshine hours is practically the same in these three cities. Phoenix, Arizona, and Cairo, Egypt, have the greatest amount of sunshine. In the tropics rickets is almost unknown, occurring merely in mild form and under conditions where the infant or child is confined indoors for a long period. Glasgow and London have the least number of sunshine hours per year. The incidence of rickets is greater and the type of rickets is more severe in London than in New York, Paris or Berlin. Glisson's famous description of the disease centered upon its occurrence in London. In Germany the disease is still called "die englische Krankheit." Glasgow, a city with the smallest amount of actual sunshine, has been known to have the greatest incidence of rickets. This city has only about half the amount of sunshine enjoyed in New York. The studies of the Medical Research Council of Child Life in Scotland published in 1926 confirm these statements. In the appendix of this report an account is given by the visiting worker of the difference in rickets between Glasgow and the section in London known as Dundee. She declared that it was common for a child after starting to walk to go off its feet. Rickets was much more prevalent and more severe in Glasgow than in Dundee. In nearly all the families with deformities the children had been breast-fed, but had seldom been taken out. Findlay in his survey of 1918 stated that it was only with the greatest difficulty that Sister Elinor could find among the patients of the Dispensary of the Royal Hospital for Sick Children a sufficient number of non-rachitic families for the needs of his research.

The Faroe Islands and Iceland serve as another example of the close relationship between the incidence of rickets and the availability of sunlight. The Faroe Islands constitute a tiny archipelago lying between England and Iceland. Rasmussen studied one of the medical districts in the Faroe Islands with a view of determining the extent of

EDITORIAL NOTE — This is the second of a series of four articles by Dr. Levine. The third will appear in an early issue.

rickets. He followed the condition of 141 children in nineteen villages from 1920 to 1922. He found that the disease had developed in 34 per cent of the breast-fed and 71 per cent of the bottle-fed babies. The islands have very little sunshine. The fog is almost constant due to the proximity of the Gulf Stream. Thorshavn, the capital, has but the annual total of 954 sunshine hours. Dannmeyer claims that the islands receive yearly much less—about 150 sunshine hours. The situation is further complicated by the fact that vitamin D is deficient in the diet of the people, since margarine had replaced fish oil. In contrast to the conditions found in the Faroe Islands we must state the findings of Dannmeyer, who maintains that rickets does not occur in Iceland owing to an abundance of sunshine. In Palermo, Sicily, we have an institute for rickets similar to those in northern Italy. It must be remembered that there are less annual hours of actual sunshine in Palermo than in New York City.

Russia also serves to show the influence of climate upon the incidence of rickets. The climate in that country is severe and complicated by lack of sunlight. In Leningrad the annual amount of sunshine hours is 1427, or about 1000 less than in New York. Joukooski in 1900 reported before the International Congress of Medicine, in Paris, upon the examination of 3224 Russian infants and children aged one month to six years. Rickets was present to the extent of 95 per cent. In 35 per cent of the cases rickets was severe. There is little rickets, however, in the Crimea, the most southerly part of Russia.

Intensity of Available Sunlight

The incidence and severity of rickets depends upon the intensity of the sunlight. The dominant point in regard to the anti-rachitic factor of the solar rays is not so much the hours of sunshine as the percentage of ultraviolet components present in the rays as well as their wave length. Some cities in the West Indies where rickets is mild and negligible, as in Ancon and in Colon in the Panama Canal Zone, have even less sunshine hours during the year than New York City. These cities in the Panama Canal Zone make up for a comparative shortage in sunshine hours by superiority in the intensity and quality of the ultraviolet rays. This superiority is due to the decreased zenith distance of the sun, which has a smaller annual fluctuation in the tropics.

Table I

Yearly Average Number of Hours of Actual Sunshine in Cities in Various Countries

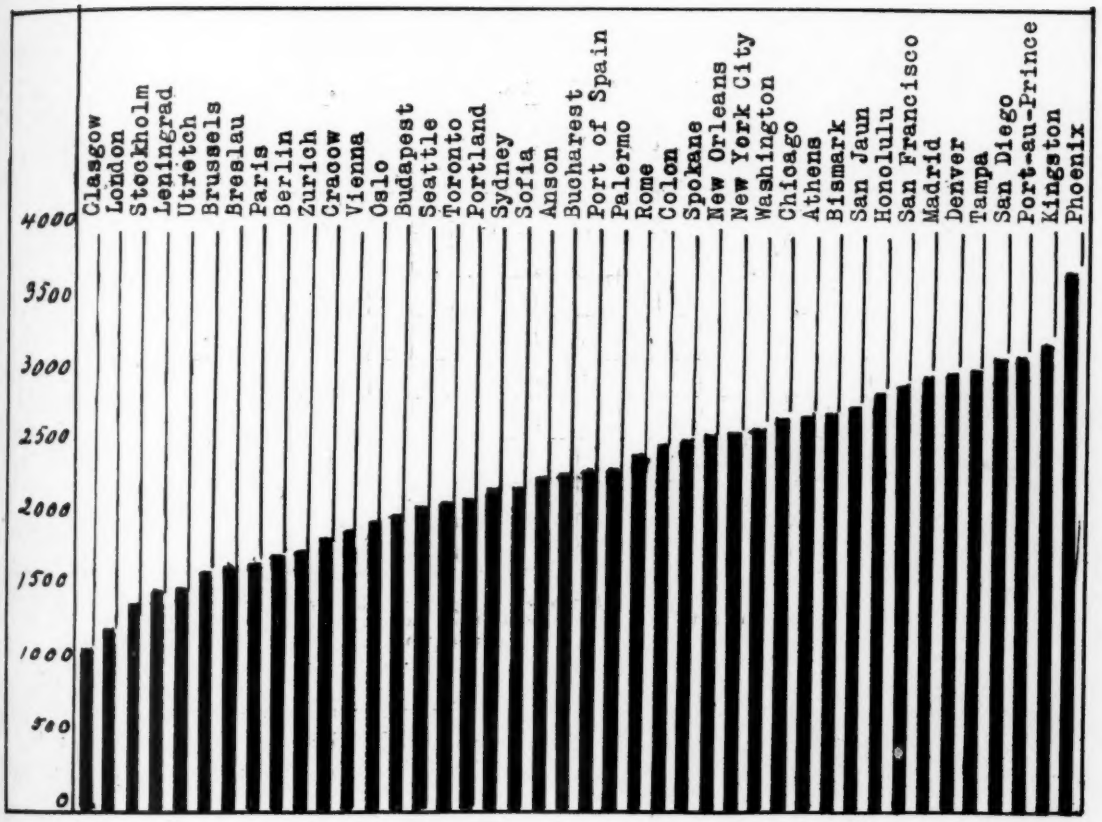
Glasgow, Scotland	1086	Rome, Italy	2362
London, England	1227	Colon, Canal Zone	2413
Stockholm, Sweden	1418	Spokane, Washington	2492
Leningrad, Russia	1427	New Orleans, Louisiana	2519
Utrecht, Holland	1469	New York City, N. Y.	2557
Brussels, Belgium	1570	Washington, D. C.	2598
Breslau, Germany	1642	Chicago, Illinois	2632
Paris, France	1663	Athens, Greece	2655
Berlin, Germany	1672	Bismark, North Dakota	2700
Zurich, Switzerland	1693	San Juan, Porto Rico	2720
Cracow, Poland	1733	Honolulu, Hawaii	2840
Vienna, Austria	1852	San Francisco, Calif.	2878
Oslo, Norway	1949	Madrid, Spain	2909
Budapest, Hungary	1963	Denver, Colo.	2946
Seattle, Washington	2022	Tampa, Fla.	2948
Toronto, Canada	2048	San Diego, Calif.	3049
Portland, Oregon	2095	Port-au-Prince, Haiti	3056
Sydney, Australia	2125	Kingston, Jamaica	3169
Sofia, Bulgaria	2145	Phoenix, Ariz.	3752
Ancon, Canal Zone	2155		
Bucharest, Roumania	2238		
Port of Spain, Trinidad	2245		
Palermo, Sicily	2261		

The quality and intensity of light vary with the season. The radiations of the sun are of much shorter wave length in summer than in winter. The findings of Dorno (see Chart I) in Davos, Switzerland, serve to illustrate the seasonal fluctuations in the type of ultraviolet rays emitted by the sun. There is a somewhat small amount of ultraviolet in the winter's rays. A rather sudden increase occurs during the late spring. The height in the increase is reached during the summer, and a graduate fall takes place during the autumn months.

The radiations of the sun are of much shorter wave length in summer than in winter. According to the findings obtained by Dorno in Davos, Switzerland, the shortest radiations in December were somewhat more than 306 millimicrons in length, whereas in June they reached 298 millimicrons. The shortest waves of sunlight that reach the surface of the earth are about 290 millimicrons. We may state in general that due to the effect of moisture, smoke and dust, rays shorter than about 300 millimicrons rarely reach the surface of the earth.

The length of effective radiation with regard to the cure or prevention of rickets is not only limited by artificial metereological

GRAPH I



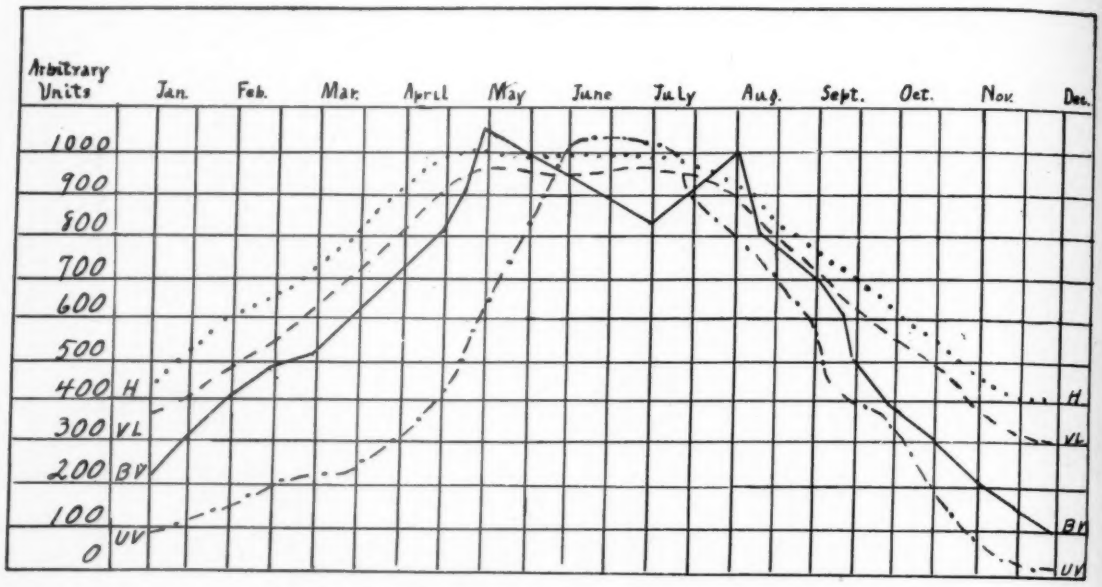
Yearly Average Number of Hours of Actual Sunshine in Cities in Various Parts of the Globe.

conditions but is markedly circumscribed by natural limitations. The effective band with reference to anti-rachitic potency lies between 290 and 313 millimicrons. Waves with wave lengths greater than 313 millimicrons have very faint or no anti-rachitic influence. The pronounced effect of irradiation with the mercury vapor lamp is due to the fact that it emits active rays of even shorter wave lengths than those yielded by sunlight. Sonne and Rekling have shown by a study involving monochromatic light that all the shorter ultraviolet rays do not exert a marked anti-rachitic action. They found the region of about 280 millimicrons highly effective, while the potency in the neighborhood of 248 and 240 millimicrons proved to be inconsiderable. It is evident that a slight difference in wave length suffices to render ultraviolet rays effective or ineffective. During the winter months the shorter ultraviolet rays do not reach the earth and the larger ones are less intense. The width of the anti-rachitic zone is reduced only to about 5 millimicrons. The small summer anti-rachitic zone and the still smaller effective winter zone emphasize the danger that window glass, moisture, dust, smoke, and other foreign substances hold out in filtering off the specific radiations.

The small band of specific radiation in the winter is not without influence in the cure of and in the protection against rickets. Hess maintains that the winter sunlight has such effect on rats. Tisdal and Brown showed that the sun's rays during the months of December, January and February in the latitude of Toronto produce slight but definite anti-rachitic effects on rats fed with a rachitogenic diet. Flemming came to similar conclusions in studying the winter radiations in Washington, D. C.

The importance of the intensity and quality of solar rays becomes evident when we study the incidence of rickets in London and in

CHART I



Seasonal Variations of the Sun's Spectrum (Dorno)
UV = ultraviolet; BV = blue violet;
VL = visible light, H = solar heat.

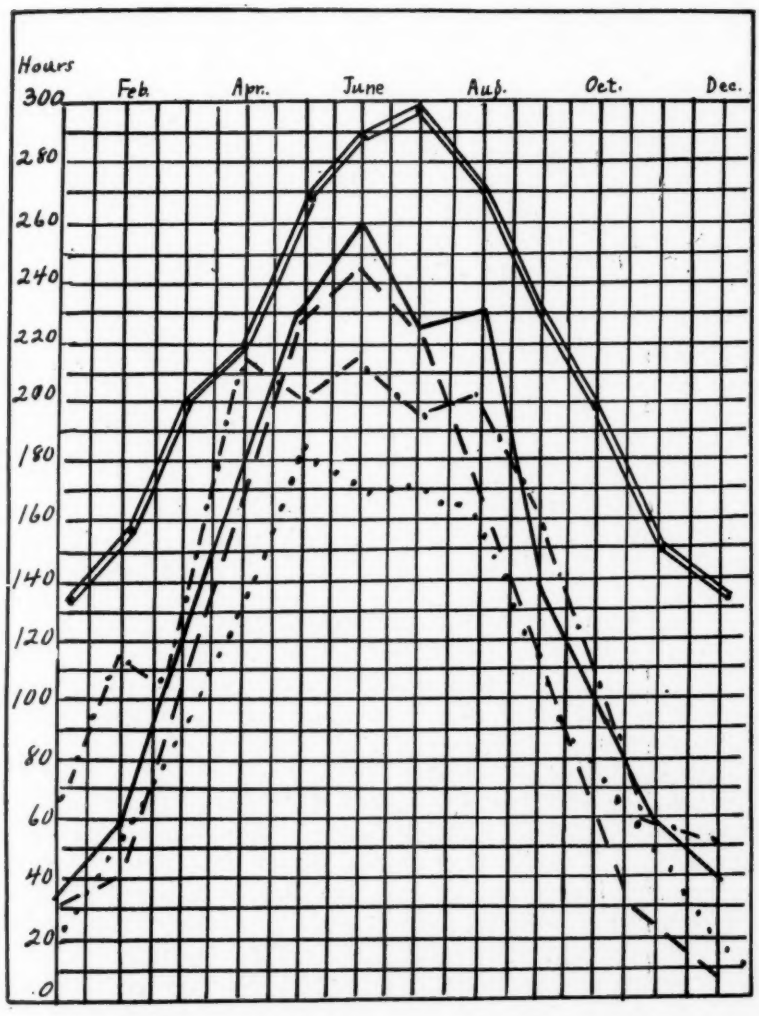
New York (Chart II). New York has approximately twice the number of actual sunshine hours per year than Greenwich, representing London. When we look at graph I we find that New York has approximately the same number of hours of sunshine during the winter months of February and March as has London during the months of June, July, and August. Nevertheless, rickets develops during the winter in New York, whereas it undergoes healing in London during the summer. About the same number of hours of actual sunshine induces rickets in New York during the winter while in London it leads to the cure of rickets during the summer. The truth of the matter is that the sunshine hours in London for the summer months are the same in number as the winter sunshine hours in New York. The sunshine, however, differs in quality and intensity and has a greater percentage of the radiations specific in rickets.

In view of the variations in ultraviolet radiations with respect to season we may expect seasonal variation in incidence and severity to be characteristic of the sun-deficiency diseases—rickets, tetany, and osteomalacia. As a matter of fact the season with the lowest intensity of ultraviolet radiations corresponds to that of the greatest incidence of rickets. In the days prior to the popular use of anti-rachitic prophylaxis, three-fourths of the cases of rickets developed the first half of the year, that is during the winter and spring months, and only one-fourth during the second half of the year. Kassowitz noted clinically the marked seasonal variation in rickets and tetany. He observed its frequent occurrence during the winter and early spring and its comparative infrequency in the summer. Schmorl as a result of extensive pathological studies based on 386 consecutive necropsies also demonstrated the seasonal incidence of rickets. (Chart III.)

Season is even a more pronounced disposing factor in tetany than it is in rickets. Kassowitz showed this fact to be true for infantile tetany, and Frankl-Hochwart for adult tetany. Motto plotted the curve of incidence of infantile tetany in Heidelberg for the years 1920-1925 and proved that in addition to a March peak there was also a rise in January. Jaffa reported the seasonal incidence of infantile tetany in an out-patient clinic in Berlin during a period of twenty years. Throughout the summer practically no cases developed.

It may be of interest to mention that there are years in which tetany or rickets are unusually common. There are also rickets-lean or tetany-lean years. Hess records the fact

CHART II



Amount of Actual Sunshine (Yearly Average) in Five Large Cities in the Temperate Zone (Hess).

New York ═══ 2,557 hours
Berlin ——— 1,672 hours
Paris —·—·—·— 1,663 hours
Stockholm — — — — 1,418 hours
Greenwich . . . . . 1,227 hours

that the spring of 1929 was remarkable for the low incidence of tetany throughout the city of New York. This low incidence prevailed both among white and negro babies. Rickets also was mild or infrequent. The winter had been rather mild and the spring rainy.

Osteomalacia, according to Miles, also reveals a seasonal variation in incidence and in severity. The incidence and severity correspond to clinical observation in regard to rickets and to the so-called hunger osteomalacia observed in Vienna and elsewhere after the World War. Remissions occurred in summer.

The relation of season to the incidence of the sun-deficiency diseases is of importance with reference to date of birth of an infant. If born in the early spring, in March or in April, an infant can count upon an abundance of sunshine during the first half year of its existence, so that rickets does not develop dur-

ing the following winter. The most unfavorable season to be born is in the early autumn, during the months of September and October. The infant born in these months will spend the first six months of its life away from specific solar radiations. Such an infant is prone to develop rickets unless specific antirachitic therapy is instituted. With the advent of spring and the months of sunlight, the signs and symptoms of the disease are apt to disappear.

Overcrowding and Density of Population

The sunlight available in any community may not be utilized because of existing conditions of overcrowding. Rickets is more prevalent in the city than in the country. According to Feer, the incidence of rickets in Switzerland in general runs parallel with the concentration of population. It is more prevalent among the children of industrial workers than in children following agricultural pursuits. In Australia much of the population is gathered into several large cities—a condition ideal for producing congestion and for favoring the development of rickets.

Overcrowding is common in industrial centers. The industries in a busy city serve to deprive us of ultraviolet by adding smoke and dust to the atmosphere. The houses in certain sections of the busy city are built high, close to one another with insufficient accommodations for the entrance of sunlight, without adequate provision for court yards. The narrow street and the absence of space for playing prevent the child and the adult from receiving adequate exposure to sunlight. It is the wretched housing conditions and overcrowding in Vienna that has led to the large incidence of sun-deficiency diseases in that city. In the past fifty years it has been reported by various observers that rickets, tetany, and osteomalacia are very prevalent and that the cases are more severe than those in Berlin and other large cities of Germany, despite the fact that Vienna has a more southerly location and more hours of sunshine than the cities of northern Germany. Fede reporting at the International Medical Congress at Rome in 1894 stated that he saw 2635 cases of rickets in the course of seven years in the pediatric clinic at Naples. The miserable living conditions among the poor and the crowding of its narrow streets contrived to shut out sunlight. Fruitnight in describing conditions in New York in 1893 stated that the large influx of immigrants has resulted in a situation similar to that obtained in the overcrowded centers in the old world and, consequently, to an increase in the incidence of rickets among the humbler classes of the population. Kieseritzky called attention to the high incidence of rickets and its exceptional frequency among European Jews living the congested life of the ghetto.

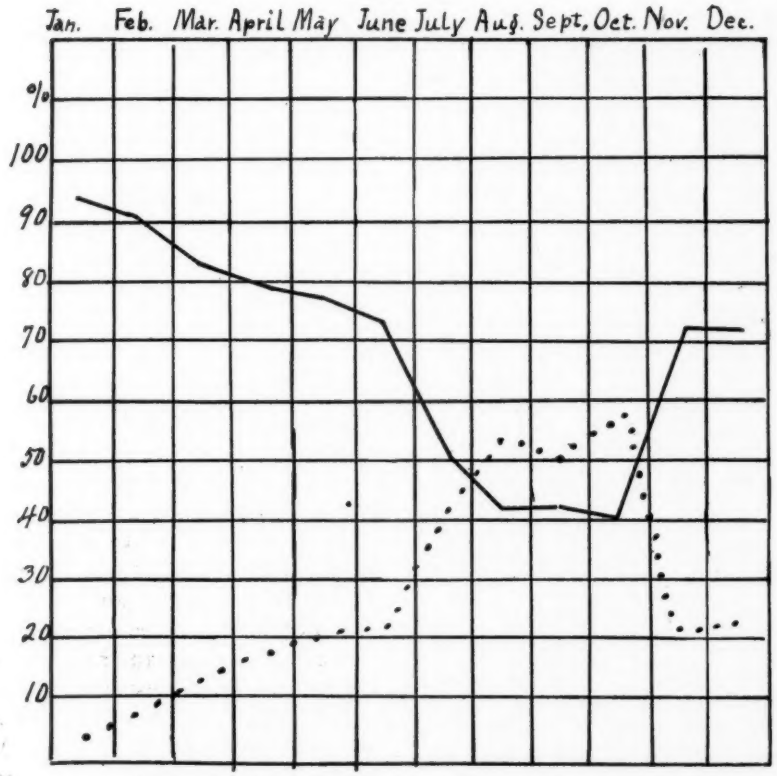
Rickets made its first appearance as a national disease in the history of the world with the modern process of industrialization and urbanization. The growth of industry led to the springing up of large cities in the north temperate zone, the stronghold of rickets. The center points of this disease were to be found in the cities of northern Europe with their industrial enterprises, and slums together with their long winters with sunlight insufficient in both quality and quantity. We are now beginning to eliminate rickets and tetany by providing sanitary dwellings and factories, and community parks, by proper feeding, and by universalizing the employment of specific prophylactic measures.

Custom and Habit

Rickets may exist even in a land of sunshine. The disease has been noted in the tropics and in the sub-tropics, although the sunshine has a greater intensity in those regions. Although the conditions are favorable for exposure to a sufficient quantity and proper quality of ultraviolet rays, babies do not profit thereby if they are not taken out-of-doors. It is therefore not surprising to find rickets in countries flooded with sunshine. A mild degree of rickets is frequent throughout the cities of the West Indies, not only among the negro but also among the white infants. Trinidad lies seven degrees above the equator and the sun's rays are sufficient in every way to prevent rickets. Yet this disease is found there owing to the fact that it is the custom to keep infants indoors. The mothers work in the field and leave their babies at home.

Rickets exists in Algeria, land of sunshine. According to Jean-Baptiste, who wrote in 1924, the disease is infrequent in the country, but frequent in the city. He observed such marked increase in rickets in clinic patients, that its incidence rose to the extent that one infant in three developed the disease. His

CHART III



Seasonal Incidence of Rickets (Schmorl)
Active Rickets ———
Healing Rickets . . . . .

conclusions are drawn from radiographic evidence. In the quarters where the indigent people lived and observed the rite of seclusion or *purdah*, 75 per cent of the breast-fed infants showed signs of rickets. Caspari observed rickets in Palestine, in Jerusalem and in Haifa, during the winter months when the children are kept in the house all day on account of wind and rain.

Altitude is a favorable anti-rachitic factor in view of the fact that it gives rise to a marked increase in the ultraviolet component of solar radiation and in view of the fact that the absorption of rays by the earth's atmosphere is lessened as a result of the absence of dust, smoke and fog. Altitude, however, does not suffice to protect against rickets if a child is not permitted to come in contact with the anti-rachitic factors in the rays of the sun. Feer found rickets in the children of the proprietor of the Alpine Hospice on a mountain pass 7000 feet high. The children were born and raised at this altitude. Because of the severe climate in this Alpine pass, the children during the first years of life were not allowed to get out-of-doors during the nine months of the severe winter.

Osteomalacia, a disease which usually commences about puberty or in early adult life, occurs widespread in countries that are by no means lacking in sunlight. Osteomalacia occurs frequently in the city of Bombay on the west coast of India, possessing a subtropical climate, moist and hot.

The frequency of this disease depends on the customs and habits of the people. The effect of custom and habit may be seen all throughout Mohammedan or Hindu countries. Krajewska published in 1900 an account of fifty cases of severe osteomalacia in an isolated district in Bosnia. The population is Mohammedan. Girls marry at the age of twelve to thirteen and thereafter lead a much secluded life. Januszewska reported in 1900 that in the course of ten years he observed in Bosnia among 20,232 patients 3510 cases of osteomalacia. Only 12 of these cases were among non-Mohammedans. The disorder de-

veloped almost exclusively among the inhabitants of the large cities. Among the rural population which did not practice seclusion or *purdah,* as in Gazin with a population of 38,0000, he did not meet with a single case. The etiological factor in this disease was not lack of sunlight, but the seclusion or the failure of contact with available sunlight imposed upon the women by the Mohammedan religion. Men enjoying greater freedom are not prone to this disease. That it could develop in the male if subjected to similar conditions is vouchsafed by the report of Maxwell, who recorded osteomalacia in a boy twelve years of age, who was confined to a dark room for a long period of time on account of measles and its sequelae.

Osteomalacia is common in China. The cause is attributed to the custom of spending much time on the *kang.* This is a platform built of brick or mud and used as a bed. It is heated by means of flues passing under it. The woman is in the habit of staying in the room on the *kang* and thus deprives herself of sunlight. When the pains of the disease come on there is an increasing tendency to stay on the *kang,* so that the symptoms become aggravated as a result of complete lack of exposure to sunshine.

Osteomalacia is prevalent in India as the result of a social custom. The high-caste Hindu women as well as the religious Mohammedan women observe *purdah.* The women do not appear in public unless veiled. They rarely leave their houses during the day. When they go out on rare occasions they wear a cloak or *uparana* which covers the whole body, and a fine net work in front of the eyes, nose and mouth. Marriage, death or a religious festival is almost the only reason for going out-of-doors. The younger women leave the house still less frequently, spending most of their time in the work of the house, in washing, and in cooking. The dwellings are so constructed that a minimum of sunlight filters in.

Custom and tradition have ordained *purdah* for the high-caste women, but the low caste women do not practice it. In western countries the social conditions of life are governed by the affluence of the individual, but in eastern countries they are governed by custom and tradition. The Hindu women who are rich obtain less sunlight and fresh air than those born poor.

The distribution of osteomalacia according to caste is illustrated from tables taken from observations of Hutchinson and Stapleton.

Table II

Distribution of Osteomalacia According to Caste and Its Relation to Complications of Child Birth

Classes	Total Osteomalacia	Frequency per cent	Total labors	Total Complications	Frequency per cent
Mohammedans	84	5.60	1484	218	16.60
Hindus	24	1.04	2300	62	2.60
Other Classes	0	0.0	3372	6	0.17

Of the 108 cases of osteomalacia recorded, about four-fifths occurred among Mohammedans, who practice *purdah,* about one-fifth among Hindus, who practice it but to a small extent, and none whatever among the other classes that do not observe *purdah* at all. It is also interesting to point out that complications occurring in the course of childbirth are greatest in number among those who practice *purdah* to the greatest extent. Out of a total of more than 7000 labors, there were 14.6 per cent complications among the Mohammedan women, 2.6 per cent among the Hindu women, and only 0.17 per cent among all other classes.

There also exists a direct relationship between the practice of seclusion and the development of osteomalacia and of late rickets. Hutchison and Stapleton state that the incidence of these nutritional disorders bears a direct ratio to the financial status of the individual. Their findings are given in the form of a composite of several tables worked out by Hess.

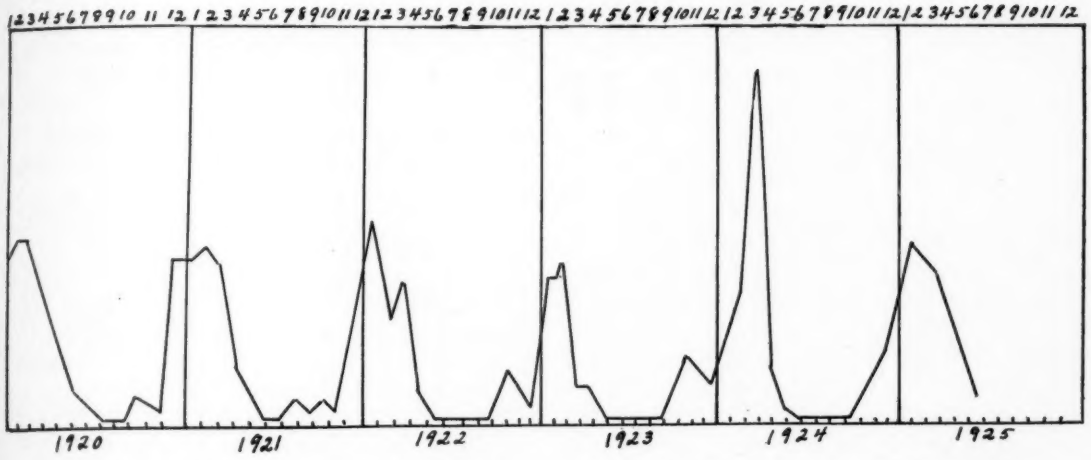
Table III

Relation of Late Rickets and Osteomalacia to the Practice of Purdah and to Economic Status

	Late Rickets Total Cases	Late Rickets Per cent	Osteomalacia Total cases	Osteomalacia Per cent
Hindus, high caste	28	70.0	27	34.7
Mohammedans	7	17.5	17	34.7
Hindus, low caste	4	10.0	5	10.2
Other classes	1	2.5	0	0.0
Seclusion practiced	35	87.5	44	89.9
Seclusion not practiced	2	5.0	2	4.0
Seclusion doubtful	3	7.5	3	6.1
Well-off	30	75.0	27	55.1
Not well-off or poor	10	25.0	22	44.9

According to these figures, 75 per cent of the women suffering from late rickets were

CHART IV



Seasonal Curve of Incidence of Laryngospasm (Japha). The numbers on top represent the months during the year, the numbers on the bottom represent the year.

well-off and 55 per cent of those suffering from osteomalacia were well-off. In reality no sharp distinction should be drawn between osteomalacia and late rickets. They are essentially the same pathological disorder. The one condition merges imperceptibly into the other. In India as well as in China, the poor who are farmers and work in the field rarely develop osteomalacia. The very rich also are not afflicted, for their diet no doubt supplies them with sufficient calcium, phosphorus and vitamin D, the equivalent of the ultraviolet rays of the sun. But the victims come mainly from the middle class, the genteel members of society too proud to work and not rich enough to afford the food that supplies the factors protecting against osteomalacia.

Since osteomalacia and rickets are sun-deficiency diseases it ought to follow that in areas where one of these diseases is prevalent the other should be of frequent occurrence. Ogata gave figures to show that rickets was rife in children under five in the districts of Japan where he found osteomalacia to be endemic. Huntly, however, did not encounter any cases of rickets in India. His failure is due to the fact that he limited his studies to the children of the poor, among whom rickets is infrequent. Hutchinson and Shah recently examined about one thousand children of well-to-do parentage, whose mothers observed *purdah*. They found about 25 per cent had definite signs of rickets. Among some 2300 children of the lower caste Hindus they found an incidence of only 5 per cent. Hutchinson and Patel conducted an investigation of rickets in Nasik, a district about 100 miles from Bombay. Their findings are recorded in the accompanying table:

Table IV

Incidence of Rickets in Indian Families in Nasik

	Number of Children	Incidence of Rickets	Per Cent
Mohammedans, Well-to-do Hindus } *purdah*	399	138	34.0
Poor Hindus	260	17	6.4
All well-to-do	236	120	36.7
All poor	333	35	9.5

The investigations of Hutchinson and Patel indicated a high incidence of rickets among the Mohammedans as compared with the Hindus, and among the well-to-do as compared with the poor. These findings run parallel to those made with reference to osteomalacia. Caste, social and religious conditions exert their influence on the adult to swell the incidence of osteomalacia. The same factors operate to increase the incidence of rickets among the growing young. There prevails a peculiar custom in India which does not permit the newly-born child to be taken out of the house for the first six months of life. The infant has, to be sure, the advantage of breast-feeding but the disadvantage of lack of sunlight.

We have in this article discussed lack of sunlight as a causative factor in rickets, tetany and osteomalacia. We have emphasized the geographical distribution of these diseases in relation to the quantity and quality of available sunshine and in relation to personal

habit and to racial or national custom. In our next article we shall take up the subject of anemia with reference to sunshine. We are fully aware of the fact that the well-defined diseases, rickets, tetany, osteomalacia, and anemia, are etiologically concerned with sunlight. We do not, however, appreciate as yet the vast amount of subnormal health and vague ill health that must prevail when people live under conditions that allow for very little contact with the forces of nature. The Italian proverb, *"dove non entra il sole, entra il medico"* ("where the sun does not go, the doctor goes"), no doubt bears justification if we look into the fundamental causes of disease. The doctor makes more visits on the darker side of the street than on the sunny side.

Civilization has taken us away from the field and the forest and the plain, and has clothed us and shut us in the home, the school, the office, and the factory. This tendency to hide from the beneficent forces of nature has no doubt brought many diseases hardly known to primitive peoples. However, we cannot go back nor do we wish to go back to life before the dawn of history. We must therefore bring into action our resourcefulness in order to modify our present-day mode of living so as to compensate for the factors leading to physical deterioration.

Too many people are ill from sunshine starvation. Rollier understood and appreciated the meaning of living in the sunlight when he put the famous inscription on the wall of the consulting room in his renowned sanitorium: *"De toutes les fleurs le coeur humain est ce qui a le plus besoin de soleil"* ("of all flowers the human heart is the one which has the greatest need of the sun"). Keyserling without reference to a scientific background for his assertion rightly exclaims in his *Travel Diary of a Philosopher*: "What would man be without the sun? He would not exist at all. The whole of his being is sun-produced, sun-born, supported by the sun and withers when the mainspring of life turns away. The more I advance in recognition the more I profess sun-worship myself. During these terrible months when the sun only throws a hasty disdainful greeting upon Esthonia . . . the curve of my life declines every time. My body feels ill, my vitality decreases, my soul loses in tension, and conversely periods of my highest creative power always coincide with the longest days."

Life must be lived in an abundance of light. It is no wonder that great artists have endeavored to depict on the same canvas the spirit of youth and sunshine. Vincent Homer, George Bellows and Frank Benson have awakened through their paintings the longing for the spontaneous enjoyment of out-door life, of fresh breezes and bright sunny days. Sorolla y Bastida, of Spain, is another painter of sunshine. His magnificent paintings are flooded with it and vibrate with the jollity of youth.

To be out in the open air whenever possible and as long as possible is the great need of every man, woman, and child. Too much time altogether is spent indoors. The sun bath is even more essential as a means of conserving health than the water bath. The hundreds of thousands of people who visit the seashore for the purpose of sea bathing derive great benefit, to be sure, from exercise in the sea water, but much greater benefit from the exposure of their bodies to the sun.

Civilization is a great gain, but it is also the mother of prevailing ill health. It is the house, the office, and the work-shop that is doing great harm to us. We have developed a race of men who fear the sky. We do not make sufficient contacts with nature. We are too much cooped up and locked in by walls and ceilings. We learn our lessons, we transact our business, we write our songs and our poems and our books under ceilings. We paint our pictures, we twang our lutes, we eat our food, we get our pleasures in pent-up places. We make our loves and dream our dreams cramped in by walls on all sides. We therefore lose the fullness of spirit that comes with perfect health, and we lose that largeness, that calm majesty, that universality with which the sky and the heavens fill our soul.

Humanity, democracy, universal brotherhood and the one God—these precious concepts have come to us down the ages through the teachings beneath the heavens. Moses gave the ten commandments under a flood of sunshine. Buddha preached under an open sky. Christ taught in the open, in the field, in the valley, and on the hill lighted by the sun.

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BIOLOGICAL SOURCES OF RADIOACTIVITY

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Introduction

It is customary when men devoted to pure research find something peculiar to the human body or find, by way of the allied sciences, something which might hold possibilities of broadening the outlook of medical science, that their findings are first given to the medical profession. In keeping with this precedent, and before elaboration of these sources of radioactivity is undertaken by the fields of chemistry, biology and physics, the announcement of this survey shall first be given to a recognized journal of the profession with the hope that by so doing medicine will have an opportunity to judge whether or not these findings will be of any importance to its workers.

Vital Radiations

Scientists have thought for a number of years that some vital radiation exists in living matter, but sober scientific research has not confirmed this hypothesis. This is especially true of human and animal life. Although the physics of radiation has progressed with rapid strides in the last ten or fifteen years, no instruments have been developed possessing the great sensitivity required to detect radiations in living matter.

Experimentors who have studied animal and vegetable tissue for radioactivity have utilized photographic plates or films. The emulsion on a film or plate is not sufficiently sensitive for the detection, measurement and study of such a minute quantity of radiation as is given off by animal or vegetable tissue. It might be possible to detect a strong radioactive source photographically, but generally speaking it is a most unsatisfactory manner of approach.

Politzer, however, has discovered that a type of radiation is emitted by growing tissues of plants. Gurwitch[1] has shown that when onions are allowed to grow with their roots extending across a photographic plate images are formed coincident with the growing root, thus suggesting the emission of some ray, or rays, capable of influencing the bromide of silver emulsion.

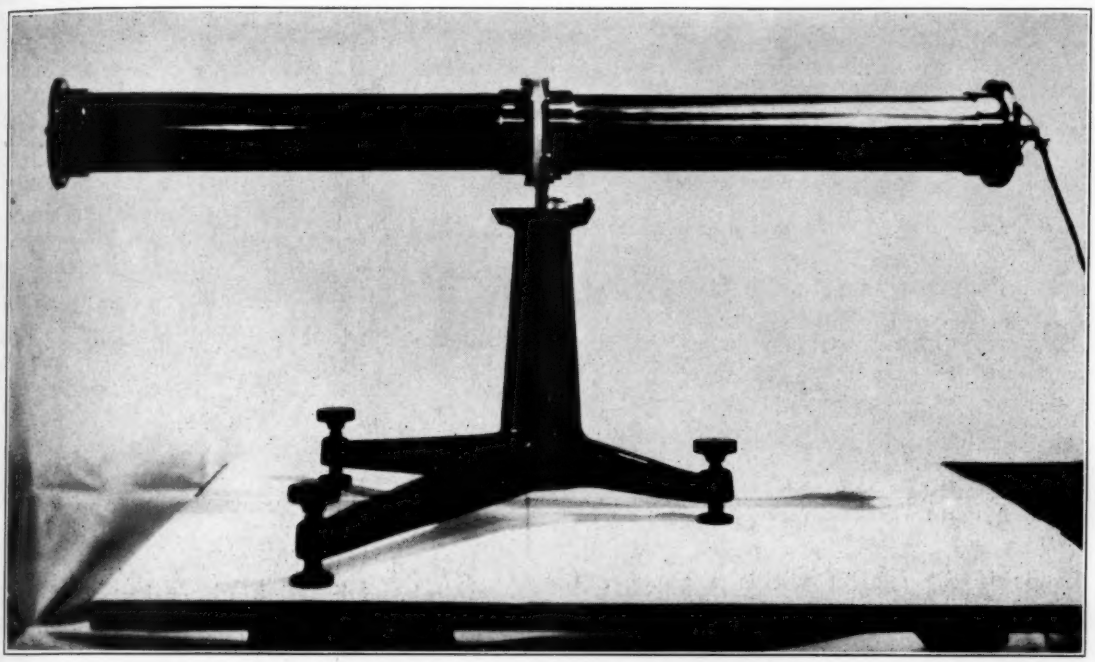
Clark[2] has discovered that the wings of butterflies emit an unknown ray which is of sufficient strength to photograph their patterns. Patterns of butterfly wings can be registered on photographic film even though the insect may have been dead for many years. Some workers state that the older the insect the less clear the photograph. One worker, however, has found that with Brazilian insects more than five years old a contact exposure of forty-eight hours was sufficient for a very clear negative. On the other hand, the writer captured a fresh specimen in Nevada and three weeks or more were required for a good negative. At a later date we shall investigate this new biological radiation, but it is rather doubtful whether the rays from the butterfly wings are the same as those described later in this paper. The rays of Politzer and Gurwitch may be the same. This has to be proven, however, for numerous workers are finding strange "New Rays," many of which other workers have been unable to demonstrate.

Instruments to Detect Small Quantities of Radioactivity

The first problem in this research was to build an instrument of proper sensitivity. A very crude device was completed in June 1930; and like the first automobile, perhaps, it was an awkward and un-workmanlike thing to look upon. It proved the feasibility, however, of such a device, and showed that however minute the quantities, radioactive emination could be detected and measured. Other instruments were designed and built, and through a process of evolution the apparatus illustrated in Figures 1, 2, and 3 finally reached completion.

Figure 1, represents the "detector." Outwardly it has the appearance of a large, overgrown spectrometer. What it really is, however, is an electrostatic detecting device from which are led two conductors to a delicate measuring instrument, Figure 2, which is situated on the opposite side of a brick wall. Figure 3, is a specially built thermionic valve amplifier, which, when used in lieu of ap-

FIG. I



Device used for detecting radioactivity in biological specimens.

paratus, Figure 2, increases the sensitivity of the device, Figure 1, many thousand times and allows one to "pick up" radioactivity which would otherwise escape detection. This instrument, together with other instruments built for this research, will be described in detail in more technical papers. It is sufficient to say here that we can now measure and convert into mathematical units radioactivity from the very smallest source of supply.

Both animate and inanimate specimens have been subjected to observation. Inanimate, or dead specimens, show no signs of radioactivity (except radium element, and other already known radioactive substances). Animated specimens, that is, plants, vegetables, fruits, animals and man, or all forms of biological life, show a characteristic radioactive intensity.

Human Radioactivity

As a working hypothesis, it was granted that certain plants and insects show an emission of some type of radiation after the findings of Politzer, Gurwitch and Clark. If this could be proved, it seemed reasonable to suppose that lower animals, and perhaps human beings also, have bound up within their cells some similar vital radiation. Carefully proceeding along these lines we found this theory to be true.

Taking small animals as a beginning, we found that each had its own characteristic radiation. The hand being the most accessible part of the human anatomy was next subjected to observation. Months of painstaking experiment showed that men and women, irrespective of individual types, had a similar radiation measurement, or one which could be classed as characteristic of the human family. We are, as yet, unable to say from these observations whether the state of one's health will materially change the factor of human radiation intensity. Our work has been conducted with normal individuals and to date there has not been sufficient variation to suggest anything abnormal; the measurements were found to be more or less constant for each individual.

Puzzling problems presented themselves, however. For instance, the hand was taken as a standard. Let us say for convenience that the hand was a unit of 1.35. Now, if we measure other parts of the body we find a great difference of measurement. The tongue gives off three times as much as the hand; the solar plexus gives off very much less than the hand, and its detection and measurement

must be done with apparatus shown in Figure 3. The same is true of the wrist, forearm, elbow and heart apex. There is about one-half as much given off by the lower dorsal and upper lumbar spines as is given off by the hand. About one-fourth of that emitted by the hand was found to be given off by the cheek, eye, and forehead. The foot shows about one-half the output of that shown by the hand.

It might be interesting to include at this point that violent exercise of any member just prior to examination seemingly produces a marked increase in the radiation output. To illustrate: if a reading be taken of the cheek to establish a normal intensity, and the subject is then allowed to engage in the vigorous chewing of tough candy, there will be a marked increase in the second reading over the normal. A similar experiment with the hand: if the subject wields a hammer for fifteen minutes, the second reading indicates a marked increase. The hand and forearm, if kept in a splint and sling for several hours will show an enormous increase over the normal output. The element of fatigue enters into these experiments. The hand, for example: in the first instance fatigue was induced by exercise; the second, by binding the hand and arm in a more or less awkward position for several hours. In both instances the hand was very tired (as expressed by the subject) and the readings were very nearly the same.

It is also very interesting to note that, if the left arm, for instance, be tightly bound with a tourniquet until the hand is almost purple from congestion, there will be no perceptible increase or decrease in the radioactive intensity. One of the most extraordinary experiments done thus far is sketched as follows: an apple, an orange, a lemon and a potato were halved and the raw surfaces placed to the instrument to establish a normal measurement. The measured fruit was then cupped between the two hands of one of the subjects for thirty minutes. A reading taken at the termination of this exposure showed the output to equal *that of the subject.* That is to say, by holding the apple cupped in the hands for one-half hour, the radiation output showed an increase of about two and two-thirds times over the normal.

A fresh apple was halved and heated over a flame until the temperature far exceeded that of the human body. Only a slight increase was found when the second reading was taken. A slight increase in intensity was to be expected.

Identical experiments were performed with the other specimens enumerated and the same results were obtained. With the potato, however, the experiment was somewhat elaborated. It was halved and measured as described above, and held by the subject for one-half hour. At the end of this exposure it was cubed; that is to say, it was cut down until only the "core" remained. A measurement taken agreed with that of the apple, namely, two and two-thirds times over the normal.

These observations are characteristic of human beings. They can be repeated over and over again. Exercise of muscle, or what we believe to be muscular fatigue, is the one important agent thus far found which will increase the radioactivity intensity of the human body. It seems feasible to suppose, however, that other causes might affect such a change. Perhaps if heat were applied to some member of the body that member would show a definite increase in its reading.

Plant Radioactivity

Flowers and potted plants have characteristic measurements. The roots of plants, however, show about twice the amount of radiation as that shown by the leaves and stems. Grass collected with all the roots present shows about twice the output for the roots as for the grass-blades. The earth about the roots when sifted from large root particles shows a characteristic intensity measurement. This is probably due to the fact that small, broken root particles still remain in the soil and emit a minute quantity of radiation. There are unlimited experiments open in this field alone. The effect of drugs, electrical and thermal injury on plants may show a number of things of vital interest.

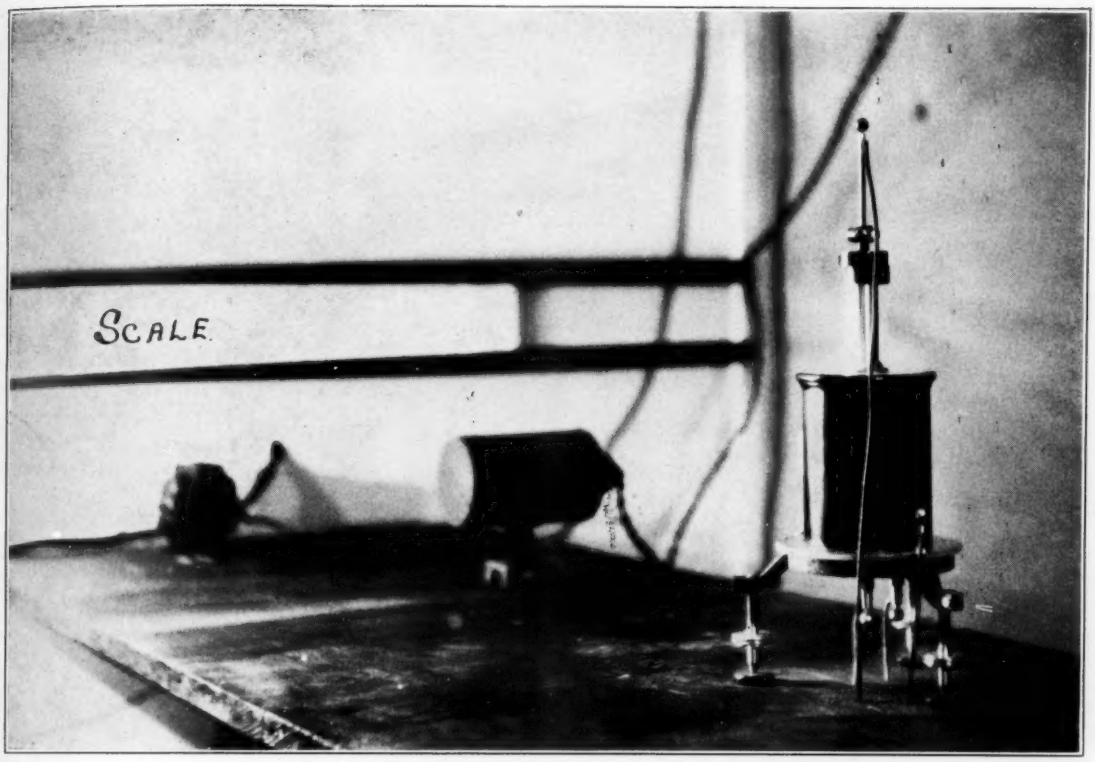
Radioactivity of Fruits and Vegetables

Each kind of fruit has its own characteristic radiation. Apples, for instance, differ from oranges, lemons and tangerines. Pears, while similar to apples, differ from bananas, lemons and oranges.

Vegetables also differ from each other. The onion differs from the potato, the beet, the turnip and the carrot.

There are very few fruits or vegetables that give off any detectable radiation through

FIG. II



Measuring instruments used in conjunction with apparatus in Fig. I

the skins. Measurements usually have to be taken after the specimen has been cut in half or peeled. The peel is either so thick that it filters out practically all the radiation, or it would seem that nature intended that the skin of fruits and vegetables confine the radioactivity to the interior of the specimen.

Nature of These Biological Rays

The penetrating power of this radiation is rather remarkable. We have found that from the hand these rays will penetrate paper, celluloid film (photographic), one-eighteenth mm. lead, 1 mm. aluminum, one-eighteenth mm. lead plus one-fourth mm. aluminum, 1 mm. glass, and one-fourth to one-half inch of wood. Various substances show a characteristic absorption coefficient. In many of the heavier substances there is considerable filtering of the rays, but the shorter or more penetrating of these rays are passed through. They are completely absorbed by two inches of wood, two mm. of aluminum, and one mm. of lead. The power of these rays is hindered perceptibly when passed through vacuum; they are also influenced by magnets.

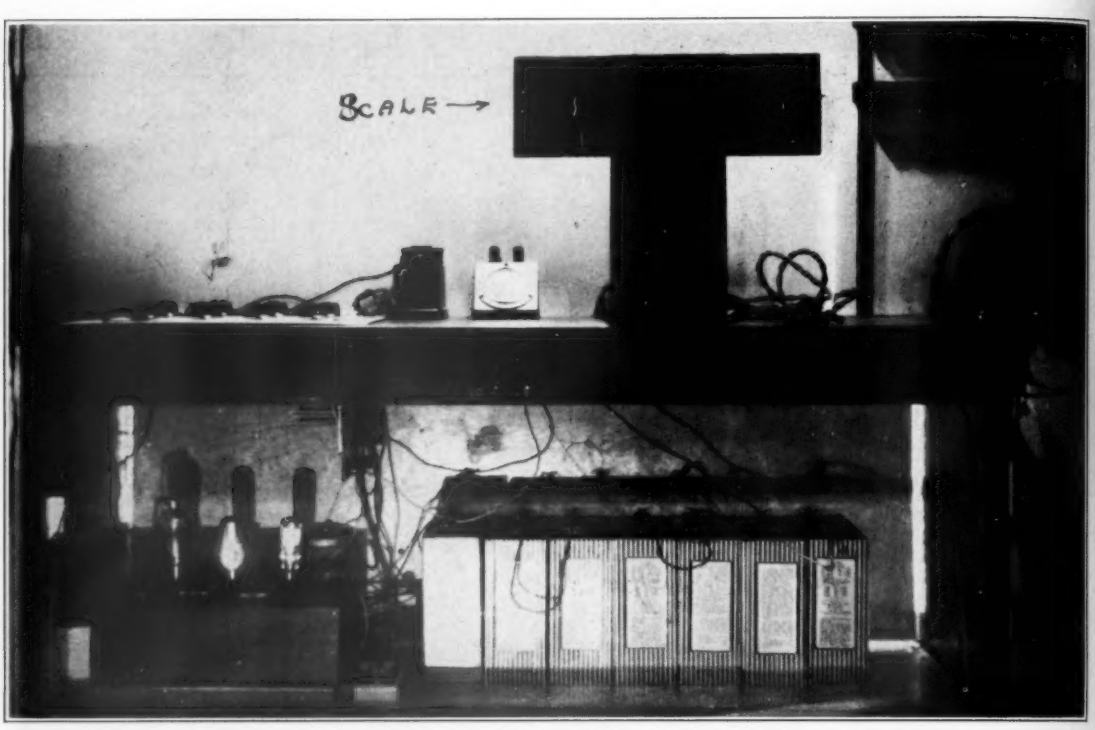
It is rather difficult to say at the present moment into what class this particular radiation falls. These rays have definite characteristics; they are of the same nature as the *alpha* corpuscles and *beta* particles; we cannot be positive at the moment that *gamma* rays exist, but there is that possibility.

We prefer, in this paper, not to state positively just what this radiation is, but reserve judgment until further research has been accomplished.

We have succeeded in photographing the track of what appears to be *beta* particles emitted from the human hand. Figure 4 is a reproduction of one of the many photographs made in our laboratory. This photograph was made with a modified Wilson chamber. The expansion chamber of C. T. R. Wilson is sufficiently well known to warrant the omission of a description. These tracks have the appearance of *beta* particles, as stated, and other evidences point to the existence of *alpha* rays; penetrating power points to *gamma,* but, when one deals with such an uncertain factor as the human body and other forms of biological life, one must be rather conservative in one's statements.

The study of biological radiations looks

FIG. III



Amplifier and measuring instruments used in conjunction with apparatus, Fig. I.

very simple on paper, especially with all its technology omitted, but I should warn the reader that it is far from being as simple as it appears. It is a most complicated bit of work, and, because we have to deal with such a minute quantity, we must expect to spend time, much labor, and exercise great patience if we are to reach a correct conclusion. We feel, however, that this is a most important field, and one which should be most thorouhgly investigated. It is the intention of this paper to present a preliminary survey of some of the work done, and to provoke thought if we can amongst workers in the field of radiology and allied sciences who will ultimately aid in bringing this work into a more practical light.

Our laboratory has new apparatus under construction which will soon be completed and which will enable our staff to make progress more rapidly. However, it will probably be a year before we shall feel justified in publishing a detailed report. In the meantime workers in the field of radiology who are familiar with the uses of electrostatic instruments are invited to contribute what they can toward the solution of this problem.

Origin of Biological Rays

There are many theories advanced as to the probable origin of this newly found radioactive force. Just what part these rays play in the scheme of things is rather problematical. No absolute proof has been submitted to substantiate any theory thus far advanced. It would probably be out of place here to include even one of these many theories. However, a bit of speculation might be interesting. It seems reasonable to suppose that a possible source of this radioactive energy might be in the atoms of the cells themselves. If this supposition be true, there is room for countless theories, all of which have to be proved.

Gaskell has advanced a theory with the idea in mind that some intra-atomic force is responsible for the living existence of the animated cell. Such a force, if it exists, would have to be detected with instruments of extreme ultrasensibility; an instrument capable of detecting energy, very minute in quantity and of exceedingly long wave length. Such a force, if it exists, would be intra-atomic, that is, bound up within the atom itself; it would be very difficult to detect, and much more difficult to measure and study.

However, physiologists tell us that, with every movement of muscle, or with every heart beat, such muscles and organs as are brought into play to do a certain amount of work, are found to have by virtue of this work, cells that die and are cast off as a waste product. Physicists tell us that, while an electron is revolving in any definite orbit, it is conceived to be non-radiating, for otherwise energy would be lost and the electron would be gradually pulled into the nucleus. Ordinarily an atom exists in a state of equilibrium, but during the transition from a higher to a lower state radiation is given off.

Muscles and organs, we know, are made up of countless cells; cells likewise are made up of atoms. If the physiologists are correct in their statement that cells die from over-activity (work), and physicists are correct in the assertion that atoms give off radiation during transition from a higher to a lower state, we have the nucleus of a theory. It is rather easy to visualize the human body as a machine which is constantly at work; constantly tearing down tissue and replacing it with new; constantly generating new cells to replace those cast off as waste at the moment their usefulness is over. It is also rather easy to visualize the atoms of these cells in the process of death giving up their energy; atoms in transition from a higher state (of living) to a lower state (death) constantly liberating energy in the form of radiation. Is it this liberated energy that we are able to detect and measure? Is part of it re-absorbed by new cell growth before it is emitted by the human body? Or, is this the so-called "force" intra-atomically contained, mentioned by Gaskell?

But what of plants, fruits, vegetables and all things alive? In animals and man we are able to follow such a line of reasoning; but with forms of life found in other kingdoms it is not so easily followed. Crile[3] has shown many facts in his paper, "The Physical Nature of Death," which may throw some light on the present problem. Plants, fruits, vegetables, etc., are alive so long as they have an electric potential; in the absence of electric potential molecular disintegration sets in. Crile states that in plants, fruits, animals, etc., an electric potential exists during life and disappears at death; that fruits, vegetables, etc., are alive, breathe, and have an existence characteristic of that form of life. Therefore, it is not so surprising that forms of life other than man should show some evidence of a radioactive energy.

Crile has also shown that the electric potential is "varied by insomnia, by anesthetics, by poisons, by hemorhhage, by asphyxia, by change in electrolytic solution, by adrenalin, by injury, by heat and by cold." Also, "at the moment of clinical death the potential difference between different organs drops to zero for a few moments; following this, each organ regains its potential for a short time, but finally the potential of all tissues drops to zero, the respiration of the tissue stops, and molecular disintegration sets in." He also found that "activity, quiescence, death, and dissolution were governed completely by the production of variations in the electric potential alone." He inferred from his obser-

FIG. IV

Electron trails the human hand source of supply. Note comma-like (,) tracks.

vations that, "the organic molecules that are bound together in the animal organism, the arrangement of crytalloids and colloids, the maintenance of the molecular organization—that all these phenomena are manifestations of electrical force. Electrical potential is the product of chemical activity, and in turn the electrical potential governs chemical activity. These electrical and chemical processes are the governing factors in the production of the phenomena which are characteristic of life. In their absence the organism is dead."

But, if the theory of Gaskell[4] has a scientific foundation (and it seems that it has) there is evidently some "force" other than chemistry and electricity responsible for the animated activity of the cells of an organism.

Might it not be that the radioactivity of the organism is responsible for the chemical activity, which in turn, is responsible for the electrical potential?

These are questions waiting to be answered. We hope, within the next few months, to answer a few of them; but not since the days of Greek mythology has an idea sprung in full bloom from the brain of one man, or one set of men. Consequently, it is an open field to those who care for speculation. It seems reasonable to hope that once this factor of biological radioactivity is solved, radiolgy will have a new knowledge that may have a far-reaching effect.*

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* The writer desires to express his thanks to Mr. E. K. Jenkins, Assistant and Engineer whose ingenuity and diligent labor has contributed much toward the success of this research.

New Invention Replaces Use of Filament and Points Way to Colder Light

A new electric lamp that approaches more closely the efficiency of the glow-worm's cold light and produces three to four times the amount of light on the same current consumed by the best of incandescent lamps has been made experimentally here by Dr. M. Pirani of the Osram concern, German lamp manufacturers.

It is a development of the familiar red neon lamps of advertising signs. Electricity is passed through a heated mixture of metallic sodium vapor and the rare gas krypton.

A brilliant yellow light is produced. Whereas a tungsten filament incandescent lamp wastes 90 to 95 per cent of the electrical energy in the form of heat, the new sodium-krypton tube produces four times as much light per unit of electricity fed it and wastes correspondingly less current as heat.

The yellowness of the light is at present a barrier to its use for ordinary artificial lighting as the light from the tube causes common objects to take on unnatural hues. The light is given out by the glowing gases and not by a white hot solid as is usual in present lamps.

An unusual feature of the new light is that the vapors through which the current passes are heated in an electric stove before entering the tube.

Glowing gas tube lamps giving white light and operating on ordinary house wiring have been announced commercially in America. These tubes contain mixtures of rare gases of the atmosphere: helium, neon, argon, krypton and xenon. They use less power than filament bulbs but are not so efficient as Dr. Pirani's experimental yellow light.

Lighting of a type similar to this is already in use in a newspaper office in Berlin. Softly glowing tubes one inch in diameter are stretched all the length of an arched ceiling, about six feet apart.

Absence of eyestrain and uniformity of illumination are advantages of the new system but the initial cost of installation is too great as yet for private homes.

White light indistinguishable from daylight, but of low watt or power efficiency has also been obtained in Dr. Pirani's laboratory by the use of carbon dioxide gas in the tubes. Another daylight tube, containing a mixture of mercury and sodium vapors, has a somewhat greater efficiency than the best tungsten incandescent lamp.

Sodium used in the yellow tube is present in common salt. Krypton like neon is present in small quantities in the atmosphere.

The use of the 110 volt current is made possible in the new artificial light by a hot cathode, as in a radio tube. Electrons boiling out from this allow the current to pass at lower voltages.—*Science News Letter,* (March 28), 1931.

AN EXPERIMENT IN THE COMBINING OF OCCUPATIONAL THERAPY AND PHYSICAL THERAPY UNDER SINGLE MANAGEMENT *

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Physical Therapy and Occupational Therapy are very closely related in their methods, yet in many instances they operate independently, one not understanding the other. Many institutions have Occupation Therapy with no department of Physical Therapy, and as a result Occupation Therapy has taken over a number of functions which belong to Physical Therapy. Likewise, we have examples where Physical Therapy occupies a position equally as inconsistent. Due to the fact that there is obvious overlapping of function and misunderstanding as to where the one begins and the other ends, the Michael Reese Hospital has introduced the experiment of placing all Occupational and Physical Therapy under a single management.

It was during the latter part of February of 1930 that the authorities of the hospital made the decision for a single management. It was the belief that its relationship was such that a plan of this kind would bring about better cooperation and coordination of effort, and result in better service to the patients and the doctors.

There were in the beginning four separate departments of Occupational Therapy, viz: general occupation therapy, mental occupational therapy, pediatric occupational therapy and the curative occupational therapy, a department closely allied with Physical Therapy. Each had worked independently, no one seemed to have known what the other was doing or trying to accomplish, and as a result there was much overlapping of function, wasting of time and general inefficiency. In addition, there was a certain amount of friction between the departmental heads, all of which was not conducive to progress in the right direction.

Our first objective, therefore, was to survey and analyze each department, to study the same type of work done in other institutions similar to our own, and to perfect a plan which would produce a smooth working machine, one that would make for better understanding, better cooperation and coördination, and a more cordial relationship between all employed in its service.

The situation was a most unusual one for a large hospital. It had all of the fundamental divisions of Occupational Therapy and Physical Therapy, together with the enthusiastic backing of the Women's Committees, but with no smooth relationship. It was therefore our problem to define the function of each division and to place all departments under a single management in order to harmonize all methods into a smooth working organization.

Because of the close relationship between Physical Therapy and Occupational Therapy, there is bound to be an overlapping of function, and as a result jurisdictional disputes often arise much in the manner of trade unions. One group may claim a certain method as its exclusive property and another group contest that claim. Such controversies, however, tend to waste much valuable time, are impractical and lead to no end of misunderstanding and trouble. As a consequence, the work suffers. These two reconstructive forms of physical treatment, however, can do an invaluable service for mankind in rehabilitating chronic and indolent pathologies and should therefore cooperate to the greatest possible extent.

In order that these two procedures may be made more clear, it is well to examine the nature of man and his surroundings to realize just what effects are produced within the nervous mechanism when he becomes crippled.

As you know, the human body is composed of many distinct systems and organs, all indissolubly united into one organism where every part is at once a means and an end to every other part. The health and life of the whole organism may be destroyed by any one of its numerous parts, because all are fundamental as well as essential to life and health.

* Read at the Ninth Annual Meeting, American Congress of Physical Therapy, St. Louis, September 8, 1930.

Anything which destroys the normal physical relationship equally disturbs the clearness and vigor of thought. When, therefore, any physical incapacity of the individual occurs, there is mental brooding which leads to a depressed state and materially handicaps and retards recovery.

It is difficult to fully realize just how these physically handicapped people feel, because many of them are very poor and depend upon the mercy of charity. Picture to yourself that mental anguish, that conflict of emotions, that indefinable something that seems to tell them that they are physically bankrupt. In the charity wards of the average hospital the busy doctors and overworked nurses, because of the numerous patients that require attention, can give little thought to them other than just the necessary medical and surgical care. For long periods of time, perhaps for months or years, and in many instances for life, these cases are physically restricted and then mentally depressed because of inefficient care. Is there any wonder that there is mental depression and slow recoveries?

When they leave the hospital, many still remain incapacitated. Their outlook on life is perverted. They are thrown back upon the mercy of society as objects of charity, and little is done to make them self-respecting individuals. Is there any wonder that this vast army becomes a social menace and an economic liability?

It was the great world war that forcibly brought our attention to the great therapeutic value of these related therapies. Previous to that time there had been little thought concerning them, although each had been practiced for centuries. It seems that until then physicians had not fully realized just what these forms of therapy really meant to the crippled patient. There had been little thought in regard to the mental state of these patients. General hospitals were, for the most part, the most idle and inactive places in the world from the patient's standpoint; the only entertainment for the sick was visiting hours, the doings of the doctors and nurses, and the gossip concerning patients. But during the war the attention of the medical profession was forcibly directed to the ill effects of our wounded men detained in hospitals without anything being done to aid them in a more rapid recovery, and without anything definite to occupy their spare time. This accounts for the sudden rise of these related methods to commanding positions in the military hospitals.

According to statistics those injured in the war are only a fraction of those maimed in civilian life. Thousands are injured daily, and if you add to this number the thousands of crippled little children, such as the paralytics, the tuberculous, the cardiacs, you have some idea of the gigantic task to which these two sciences must lend their assistance. It can readily be seen that each has an unlimited field of useful activity.

With this brief review before you, let us see just what part Physical Therapy and Occupational Therapy play in the rehabilitation of crippled life. Just what is the relationship, the differences and the points of conflict?

Occupational Therapy has been defined broadly as the science of prescribed work. Mrs. Eleanor Slagel has given this witty definition: "It is directed activity, and differs from all other forms of treatment in that it is given in increasing doses as the patient improves." The definition that has been adopted by the National Association as best describing the functions of Occupational Therapy is the one given by Dr. A. H. Pattison of the National Tuberculous Association. He states: "Occupational Therapy is any activity, mental or physical, definitely prescribed and guided for the distinct purpose of contributing to the hastening of recovery from disease or injury and of assisting in the social and institutional adjustment of individuals requiring long and indefinite periods of hospitalization."

Physical Therapy, on the other hand, is defined as the use of natural forces, such as light, heat, air, water, massage and exercise in the treatment of disease. Another definition, which is more inclusive, states that it is the scientific use of certain forms of light, heat, air, water, massage, electricity and exercise in the treatment of certain abnormal tissues.

You will note that the definition for Occupational Therapy is rather broad and seems to include much that is Physical Therapy. For example, the phrase, "any activity, mental or physical" is used. The word "activity" is defined as anything which is active, an active agent or force; and the word "active" is defined as having the power or quality of motion or action as opposed to passive. An active movement is that which is initiated by

the patient and is termed "exercise"; therefore, exercise for its therapeutic value is a part of Occupational Therapy. But Physiotherapy also defines exercise as a part of its field. Wherein lies the difference between the two?

I do not like to burden you with technicalities, but it is essential to point out the fact that there is some confusion of thought as to just what constitutes Physical Therapy and Occupational Therapy, especially from the standpoint of exercise. You appreciate these difficulties when attempting to combine the two sciences under single management. The function of each must be understood, defined, and clean cut.

Physical Therapy, on the one hand, through utilization of the natural forces, improves the circulation, frees scars, stretches adhesions, and is largely a passive form of treatment, leaving definite limitations in the psychological element. In other words the technician largely does the work. Occupational Therapy, on the other hand, produces an incentive, an interest, creating within the patient the desire to do and is hereby largely active. Thus, we see that in the former, the patient's attention is focused on the injury, while in the latter his interest is in the work, and in this way his attention is taken off the injury. One without the other, however, is not as successful as the combination. It is a known fact that where Physical Therapy is used alone, the patient may not progress as fast as he thinks he should, and as a result he loses faith in it. However, by combining the two, experience shows that recovery is speeded up. Moreover, it is believed that success in the treatment of stiff joints, for example, can be increased by the combination of Physical Therapy, first preparing the part with the use of heat, massage, etc., for the activity of Occupational Therapy.

It is my belief that the misunderstanding appears largely within the field of exercise and that the explanation just given helps to clarify the two. The physiotherapist utilizes the field of therapeutic exercise, which is both passive and active with different forms of gymnasium equipment, the patient doing as instructed, which tends to focus the attention upon the part treated and hence the work becomes more or less mechanical. The human body is more than a machine and the form and repetition of a movement either with or without apparatus is not of maximum therapeutic value in increasing the amount of movement of an injured joint, or as an integral part of a larger coördinative movement. Thus, there is no psychological stimulant for personal initiative or for sustained effort. This can only be secured in the ordinary occupations or in play.

The time element is another very important consideration in describing the relationship between the two. Ordinary Physical Therapy given to a patient at the most lasts for about an hour; while Occupational Therapy may consume the remainder of the day, depending on the patient's interest and capacity. In this way the mental aspect becomes consuming and the resultant exercise is done without focusing attention upon the injured part, which as you know, is of tremendous value in promoting a more rapid recovery. It may be added that when the patient goes to the curative workshop, he is taken away from the hospital into more delightful surroundings. This change helps to overcome the bad mental effects of hospitalization and thereby hastens recovery. Going to and from the workshop aids in the exercise program.

The scope of Occupational Therapy is evidently much larger and more inclusive than Physical Therapy. The Occupational Therapy technician acts more as a teacher, creating initiative, and in this manner may take care of larger groups and thereby create a much greater variety of interest. In Physical Therapy, however, the work is more individualistic, more confined, and the technicians are unable to take care of at the most more than three or four patients at a time. For example, in muscle re-education, the technician must ever be on the alert to see that the patient avoids muscle reduplication, for great harm may be done here if this is not accurately observed. We see, therefore, that Occupational Therapy has a much wider range; is not so confining, and does everything it can to create initiative within the patient; while on the other hand, the physiotherapist must concentrate to a greater degree upon repeated individualistic effort. This, of course, does not tend to create initiative, but rather tends to produce monotony.

In considering the social aspect of the two, Physical Therapy does not stress this point,

while in Occupational Therapy this is very important. As you know, in Occupational Therapy the patients work in groups and in this way a competitive as well as a cooperative spirit is kindled which also produces an important incentive.

In the matter of training technicians, both the prerequisites and the subjects taught during the first year are very much alike for Physical Therapy and Occupational Therapy. Each demands a high school education, preferably a college degree, as entrance requirements to any of the well recognized schools of Occupational Therapy or Physical Therapy. The remaining courses differ due to specialization which these fields require, Occupational Therapy is largely concerned with the crafts, while Physical Therapy is concerned with the utilization of natural forces.

From the foregoing, it can readily be seen that the relationship is very close, and that the entire subject could be better grouped under the name of "RECONSTRUCTION THERAPY." It may be said that in Physical Therapy the physical takes prominence, while in Occupational Therapy the mental is the primary object behind the treatment. But in reality the Physiotherapist prepares the patient for the Occupational Therapist. Physical Therapy of injuries should be started early, and, at the same time, indirect or psychological Occupational Therapy should commence. Physical Therapy is continued then with the curative Occupational Therapy as soon as deemed advisable until a maximum improvement is reached, and before the treatment is ended, vocational training, if needed, may be started.

In order to make this clear, let us follow the patient in the hospital through Physical Therapy and Occupational Therapy. In the early stay in the hospital the diversional Occupational Therapy can be initiated along with Physical Therapy; as for example, take a patient with a fractured leg. Here Physical Therapy is initiated, and the Occupational Therapy worker brings in books of perhaps instructs the patient in basketry or anything else that will tend to interest him during the time that he is not being taken care of by the doctor, nurse, or physiotherapist. A little later we can use the curative workshop along with Physical Therapy, not only to occupy the mind, but to utilize the crafts in restoring impaired functions. It may include any occupation that will assist to re-establish the habits of industry and obtain certain vocational leads. This brings us up to what is termed prevocational therapy which should be followed up where indicated in the hope that it will lead to some trade or industry and include occupations that will help better to provide for the patient and his family after he has received the maximum benefit from Physical Therapy and the Curative Workshop.

The whole process of Physical Therapy and Occupational Therapy is one of mutual instruction, both working hand in hand, although performing their specific functions, toward a common end—that of restoring the maimed patient to maximum health standards in the quickest possible time.

The attitude of the insurance and industrial companies is becoming resigned to Physical Therapy, but Occupational Therapy is as yet not fully appreciated. This may in part be due to the fact that in many places physicians are being put in charge of the former, while a technician takes charge of the latter and as a rule works independently of the department of Physical Therapy. It is best that these two therapies work together, and better under the supervision of a physician in order that we may educate the physicians, the insurance companies, and industrial concerns as to the tremendous possibilities of this valuable combination.

Knowing these important facts concerning Physical Therapy and Occupational Therapy, and having analyzed our own situation at Michael Reese Hospital, together with that in other like places, we were much better able to draw up a plan that would be effective and create a clearer understanding. The whole was departmentalized, the relationship with the director made clear, and the functions of each department were defined and outlined.

Five divisions were created, a departmental head placed in charge of each, and these in turn made responsible to the medical director of these divisions. A full time secretary was obtained and put in command of the business management and clinic routine under the director in order that all divisions might be properly correlated. In this way all matters of importance are immediately brought to the attention of the medical director.

Division One is Physical Therapy and is

divided into two sections, (a) clinic and part pay patients, (b) private patients from the hospital and the outside.

Division Two is the Curative Workshop located next to the Physical Therapy clinic. The chief functions of this division are:

(a) To work in close association with the division of Physical Therapy. Physical Therapy preparing the part of the Curative Workshop.

(b) To direct attention toward the diseased or injured part.

(c) To keep the socializing influence constantly in mind.

(d) To obtain vocational leads.

(e) It may have an economic aspect as is stated under the division of General Occupational Therapy. However, the work is more individualistic and closely interwoven with Physical Therapy.

Division Three is general Occupational Therapy for adults. The function of this division is largely recreative, being chiefly concerned with the mental aspect. However, it must be remembered that a real service can be rendered by obtaining vocational leads and in this way assist in some measure in giving economic assistance, first by teaching them a vocation which may lead to their self-support, and secondly, to sell articles which they make and give partial monetary help in this manner.

The work of this division divides itself into three parts: (1) the work in the hospital proper, termed "bedside work," (2) the shop work, and (3) the homebound work.

Part One has to do with the bedside work, the Occupational Therapy worker going into the hospital wards and rooms and interesting patients in Occupational Therapy. This is done to encourage them to take part in delightful occupations, and by so doing to take care of their spare time and promote a more rapid recovery. All patients are prescribed for by the physician in charge of the case in order that the work given may be kept within the capacity of the patient. In other words, it is a duty of this division to take care of the spare time of bed-ridden patients when not being attended by the doctor, nurse, or physiotherapist, and by so doing make their stay in the hospital a happy one if that is possible. The Occupational Therapy worker must very carefully observe hospital etiquette. All requisitions must be seen by the medical director in charge of these divisions, and receive his official approval. The work in this division should be started as early as deemed advisable by the attending physician.

Part Two is the shop work. As soon as possible patients are encouraged to go to the shop. Here the work can be made heavier and certain vocational leads obtained where advisable. In the shop the social aspect comes into play, the purpose of which is to make the patient forget himself in a delightful atmosphere of interesting occupation and pleasant association.

Part Three is the home-bound work. It is the plan here to be ever alert to those patients who when leaving the hospital may be homebound. Such work may not only be recreative, but have an economic value as well for those in need of financial assistance.

It is essential to note the distinction between divisions number *two* and *three*. Number two is the curative workshop and directs attention toward the diseased or injured part, while the general occupational therapy is largely recreative.

Division Four is the Pediatric Occupational Therapy and is in reality General Occupational Therapy dealing with children. The curative workshop is here utilized in the same capacity as was explained under general Occupational Therapy.

Division Five is the Mental Occupational Therapy and is in reality a research division. This is under the intimate direction of our Dr. Eisler, a psychiatrist, and is only indirectly connected to the other divisions.

Under the business administration which coordinates and correlates all divisions the following functions are outlined:

1. All requisitions for equipment and supplies are signed first by the divisional director and made in duplicate, the original going to the business office, entered properly in an inventory book, approved by the medical director and then sent through the proper channels.

2. All matters of policy are to be referred to the medical director for decision.

3. A yearly budget is to be prepared by each divisional head and submitted to the medical director for approval.

4. All criticisms and recommendations should be made in writing to the medical director.

5. All reports and other matters of business are to be turned in to the secretary.

6. All divisions are urged to keep in close touch with the business administration in order that all matters may be taken care of promptly.

We are now in the midst of our experiment and all is apparently going very well. The personnel is excellent and enthusiastic. The Physical Therapy departments meet weekly as do those in Occupational Therapy, and once each month we meet together and discuss our common problems, and as a result, many interesting ideas are continually being advanced. All are apparently alert and doing their best to advance the status of their departments.

The hospital has become very much interested in this amalgamation and, as a result, have given their consent to building plans which will better house both the Occupational Therapy and Physical Therapy, for by so doing, we believe that they are catching the vision as to the possibilities of such a move. New equipment has been added as well as additional technicians and a full-time secretary.

We hope that as our experiment progresses that Occupational Therapy and Physical Therapy will continue to work for a common end, for unity of purpose, for coherence of effort and for proper emphasis upon essentials, so that we can do our share to make the world a better place to live in.

Discussion

Chairman Ewerhardt: Most of us are familiar with the difficulties encountered by all pioneers in medicine. Physical Therapy has had its full share of criticism leveled against it by those least familiar with its basic philosophy or its purposes. Much of this situation has been overcome by the tolerant attitude of the American Medical Association and by the profession at large. Ever so often a myopic member of the profession rushes into print with what he considers a brilliant idea. This has recently been exemplified in a published article in which the author with a technician in occupational therapy decried the over-enthusiasm of physical therapy and suggested that much more could be accomplished by occupational than by physical therapy. It is a certainty that such an opinion emanated from the pen of an immature person, one blinded by his enthusiasm for expression without due deliberation or experience. I have been an open advocate of occupational therapy for many years, but I have never lost sight of the fact that physical therapy is an important and often a most necessary precedent to occupational therapy. Dr. Molander has expressed the most rational attitude in regard to both methods. Very frequently, there is need for both, each measure to be administered or divided according to indications of each individual case. Hence, there is a definite need of administering their treatments under the supervision of a medical director who is thoroughly oriented in both methods of treatment. It is as essential to have occupational treatments given under medical supervision as that of physical therapy. In that manner much of the wasted efforts and untoward complications will be reduced to the lowest level.

It is my personal sentiment that there is at present a definite need to correlate all of the methods now used in rehabilitating the chronic cases. There is often a tendency to overlap treatment methods wherever the departments are loosely connected or operating independently of each other. Staff members divide their support in proportion to the active solicitation they receive. It has happened therefore that many early fracture cases have been receiving occupational therapy instead of physical therapy with consequences not complimentary to the treatment. On the other hand the physical therapist has often lost sight of his limitations because of his enthusiasm and close contact with method. To summarize my opinions, it is my belief that physical therapy should be used first and then later in combination with some form of occupational therapy. Both methods, however, should be under the direction of medical supervision.

Miss Geisel (St. Louis, Mo.): I have been in physical therapy work for some time, and just recently I happened to be surveying some shelter shops in New York City and I offer quite a new viewpoint after having spoken with several men who have been doing shelter shop work in New York City with physically handicapped people. That is the reason I went there for a visit of ten days or more. After hearing these men speak who have been in the work some thirty odd years, I approached the subject from the physical therapy viewpoint and then the occupational therapy viewpoint.

One doctor said to me, "You are giving the occupational therapy too much viewpoint, Miss Geisel. When these physically handicapped adults come out into the world, we have no place to place them. Give them more of a commercialized vocational viewpoint and get them started, because we have this group of people coming out from the hospitals that we can't take care of from the charity organization viewpoint."

Hearing this man talk to me for over two hours, I couldn't help but feel that sometimes we are giving too much in the hospital towards the occupational viewpoint and not enough to the vocational and commercial viewpoint. I think physical therapy, as you said, Dr. Ewerhardt, has its place definitely in our acute cases. Having worked several years with Dr. Ewerhardt and knowing fracture work, acute injury cases, nerve injuries and so forth, I feel physical therapy has a definite place first, and then we can turn them over to the occupational side. I

think the physical therapy background should be a physical therapy background first before you have anything else.

Miss Estelle Wingler (Chicago): The subject under discussion, that of combining physical and occupational therapy under a single directorship vividly recalls my war-time experience in the army of the Central Powers in the recent World war. I was a war nurse in the Austrian army and had four years of intense service in hospitals where all methods of treatment were utilized on a stupendous scale. I saw the splendid results of extraordinary surgery coupled with the after care by physical and occupational therapy.

In 1915, I joined my hospital training school, the *Wiener Universitäts-Kliniken* and *Wiener Kaiserlich-koenigliches Allgemeines Krankenhaus* which had at the outset a bed capacity of 6,000, but was later greatly increased by improvised extension barracks. I was assigned to the surgical section which was divided into two units. The first was under the directorship of Professor von Eiselsberg, the second under Professor von Hochenegg, where I was on constant duty. Both of our surgical clinics had their own field hospital contacts. Special transport trains brought all of the special cases to the attention of the surgeon in the shortest period of time. I was in charge of the military receiving station of the second surgical division clinic located in the first court next to administration building of the *Wiener Kaiserlich-koenigliches Allgemeines Krankenhaus* in charge of von Hochenegg.

I shall not attempt to describe in detail the remarkable situation of this most extraordinary period. Everyone labored in his respective specialty almost beyond human endurance. Ladies of highest nobility and court circles worked side by side with the regular nurses, and were subject to the same orders of duty as the ones from less fortunate walks of life.

The orthopedic division was under the direction of Professor Lorenz and his son. Physical Therapy and occupational therapy were used on probably as large a scale as it ever was utilized in the history of the world. The objective was to heal and reconstruct the wounded soldiers to a condition of greater usefulness and independence. By this means a greater number were either more quickly returned to combatant divisions or prepared by occupational education to positions where they became self-sustaining and independent of charity. Any one who went through the experiences of war nursing during the World war came out of it with a conviction that physical and occupational therapy were probably the outstanding contribution of this unhappy and tragic experience.

Dr. Norman Titus (New York City): The main trouble I find with the combination of the two is the fact that occupational therapy is run by ladies who like to donate their time and get in the way. They always think they know more than the doctor and they get to be a general nuisance, so-much-so, I just send my patients to the occupational therapy department and pray that what I want done will be done. If I go over there to direct the actual treatment or do any more than just suggest what I want done, I have to "butt" into a lot of ladies who have nothing better to do, who just want to come up and help the poor patients and express their ideas about what they think should be done.

Occupational therapy is the logical follow-up of physical therapy and it should be directed by one who directs the physical therapy treatment.

Team work in New York is not as perfect as we would like. There is a little too much social interruption—I had better say society interruption. They get up a benefit at Christmas time which generally costs the service a couple of thousand dollars because the costumes of the girls in the show are so expensive. I must say occupational therapy in New York is not a big thing, except from a society standpoint.

Chairman Ewerhardt: Dr. Titus spoke of the situation as it was in New York and as it was in St. Louis long ago. We have advanced far above that situation. It is really worth while to come out and see us. It is really quite different now. Dr. Titus is correct. There is a great danger in the social aspect.

Then there is another situation that often may happen to some patients. Some of these patients get so spoiled that they do not afterwards want to do an honest man's work. They enjoy being sick all their lives. I know of a few cases working in the shop sometimes who don't want a job anywhere else, because they have a shop there, the ladies make a fuss over them, Christmas comes around and they get a Christmas present and when Easter comes, they get an Easter egg, and they don't want to go out. There is that danger.

Miss Elizabeth D. Waller (St. Louis, Mo.): Dr. Ewerhardt, may you and I invite Dr. Titus to come and see the occupational therapy school where trained occupational therapists are graduated annually in St. Louis? We do not have very many volunteer unpaid occupational therapists.

Dr. J. H. McCurdy (Springfield, Mass.): I am very much interested in this experiment by Dr. Molander. My reaction to this new venture is somewhat different from that of Dr. Titus. I do not fear the over socializing effect of occupational therapy, but I question whether the mechanical effect has always been what it should. As I have seen occupational therapy in a number of cases and look back from the vocational standpoint, I think they have done bad work, not that it is necessary to do bad work, but they have carried the patient over into vocational work too early, and the person, for instance, with an elbow that can't be straightened out, learned to use the shoulder and do things with it. That person forms a habit of using that arm in a way that will cripple him always because the physical therapy side of it has not been carried far enough and he has not secured range of movement in that joint. That is one reason I am so much impressed with what Dr. Molander has stated as the integration of the various departments, so that the patient will actually

get a square deal as well as learn something in a vocational occupation.

I like the emphasis that was given here to the vocational side, to introduce it as early as it can be given, but I would like to see us work very definitely to get full function of that part, so that as the people get into a vocation, they can actually do better work.

Dr. Disraeli Kobak (Chicago, Ill.): Something unusual has happened to the staff of the Michael Reese hospital to make it the most progressive physical therapy-minded institution in Chicago. It has been generous in supporting and encouraging this new venture in the care of its vast clientele beyond that of any other hospital in Chicago, and it can be ranked with the most progressive in America. The authorities at that hospital are offering physical therapy a greater opportunity to demonstrate its worth than anywhere in Chicago. I attribute this change of interest to the fact that it has learned to appreciate the possibilities in physical therapy because of the presence on its staff of several of the outstanding pioneers in this particular field. No institution, no matter how well endowed, is willing to enter into an adventurous experiment in which the initial expenditure cannot be recovered by immediate profits. There must have been an early appreciation of the results obtained with these measures and a respect for the directors of this department. The experiment of combining physical and occupational therapies was an inevitable one in the light of the progress made by both methods in recent years. In institutions where both are operating independently of each other the overlapping of efforts has resulted in distasteful but polite conflict. We are seeing this situation exemplified at this very moment in the opposing opinions just expressed by Dr. Titus and Miss Waller. I appreciate the attitude of Dr. Titus because I have also seen occupational therapy socialized by well intentioned but misinformed management. Nevertheless, occupational therapy has a better and well assured future when it is directed by one thoroughly acquainted with its possibilities, its limitations, and one whose medical background is such that he can combine both physical and occupational therapy to the best advantage of the patient and hospital. I predict that under the medical supervision of Dr. Molander that this experiment will be a success and a contribution of outstanding importance in the future management of those ailments best indicated for physical and occupational therapy. It would be interesting to have another report next year of the progress of this experiment.

Dr. C. O. Molander (Chicago, Ill.), closing: I have not been at the Michael Reese Hospital long enough to discuss this situation with authority. The occupational therapy workers were very much interested in trying to maintain their status. It was at this time that some ideas regarding how we might interest the medical staff were brought up. This is just a young experiment. I am sure I am doing everything I possibly can.

The reason I made the statement that a combination of this kind was very good is due to the fact that a physician can get in pretty close cooperation with the doctors by just engaging in personal conversation, rubbing shoulders, as it were. Intensive effort along that line, together with little displays in occupational therapy and a number of other little methods were used. We are to have the first scientific session at Michael Reese Hospital this fall, and it is there I hope to show them this valuable combination of work.

Dr. Kobak: May I ask: is this meeting which is to be held this fall in Michael Reese to be exclusive for the members of the Michael Reese Staff, or will you invite outsiders?

Dr. Molander: I don't know. I know I have just been invited to take care of the first scientific session. I don't know whether outside men are to be invited.

British Journal of Physical Medicine

We are asked to announce that in future the *British Journal of Actinotherapy and Physiotherapy* (17, Featherstone Buildings, London, W. C. 1.) will be published under the title—"THE BRITISH JOURNAL OF PHYSICAL MEDICINE (incorporating the British Journal of Actinotherapy and Physiotherapy)". This alteration takes effect from the current month's issue, which forms No. 1. of Vol. 6. The new title has been adopted in response to numerous requests, and in order to indicate more clearly the subjects covered by the *Journal*, viz:—Actinotherapy, Heliotherapy, Electrotherapy, Radiotherapy, Hydrotherapy, Climatotherapy, Thalassotherapy, Manipulative Surgery, Massage and Exercise. Subscription rates remain as before—one guinea, post free, per annum, including special issues. (U. S. A. 5 dollars).

Meeting of the American Physiotherapy Association

The American Physiotherapy Association will hold its annual convention in Philadelphia, Pa., June 8, 9, 10, 11, 1931. Headquarters, Pennsylvania Hotel, 39th and Chestnut Sts. All members and guests of the American Medical Association are cordially invited to the scientific meetings. Program will be posted at the American Medical Association Headquarters.

EXERCISE IN RELATION TO HEART DISEASE *

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An aphorism of Celsus tells us that "Laziness slackens and dulls the body, but labor strengthens it and makes it firm." It is generally recognized that regular exercise increases the size of the muscles, creates a feeling of exhilaration and confers the ability to perform with ease many tasks which were previously difficult. Appreciation of these facts among the laity has lent enormous vogue to gymnasia, to the morning exercises of the radio and to the less desirable but more expensive mechanical exercisers. The danger of too violent exercise or in certain instances of even moderate exercises has also been emphasized.

After years of neglect a man of fifty may become thoroughly alarmed about his physical condition and may start a schedule calculated to make up in a few weeks for his many years of inactivity. More often he undertakes sudden violent exercise without premeditation and under stress of circumstances. It may become suddenly necessary for him to crank an automobile, to lift a heavy weight or to run for a street car. Serious accidents and even fatalities occurring under these circumstances are too well known to permit of any doubt concerning their reality. Ordinarily such untoward events are considered to be due to disease or insufficiency of the heart or circulation.

The Effect of Exercise on the Heart and Circulation

Consequently it is necessary to consider in some detail the effect of exertion upon the cardiac and circulatory mechanisms. Work is possible only by means of the expenditure of energy, to maintain which an increased volume of oxygen must enter the body and must be carried by the blood to the tissues. Exercise, therefore, is accompanied by increase in the output of blood from the heart, by a more rapid pulse rate and greater output with each heart beat; changes which ordinarily are proportional to the degree of exercise. In trained athletes of the greatest physical ability, the degree to which the heart and circulation may compensate to exercise seems almost incredible. Ordinarily a man of average size has at rest a pulse rate of 60 or 70, an output of blood for each beat of the heart of approximately 3 to 4 ounces, and a total blood flow of 6 or 7 quarts per minute. The Cornell runner studied by A. V. Hill[1], was found to have with his best effort a pulse rate of 180. From his oxygen absorption during exercise it was calculated conservatively that his blood flow must have amounted to about 35 quarts a minute or seven times the entire volume of blood in his body. Six to seven ounces must have been delivered from each side of his heart with each cardiac impulse. When it is remembered that a normal heart weighs only about one pound it is apparent how extremely efficient the mechanism must be and what a tremendous reserve is possessed by the unimpaired heart. For the accomplishment of so much work the demands on the coronary circulation are enormous. Hill has calculated that the need of oxygen for the heart alone may exceed that of the whole body during rest.

At the inception of violent or even moderately severe exercise there is a contraction of splanchnic vessels and probably a corresponding dilatation of the capillaries of the muscles and of the heart. Although this is a helpful and probably a necessary mechanism, it is accompanied by a sudden change in blood pressure which ordinarily attains a height of 160 to 180 mms. but in certain instances and with violent effort may reach quite alarming levels. Thus in one of Bock's [2] subjects who was doing heavy work on a stationary bicycle the systolic blood pressure was found to be 260.

Although the mechanisms for accommodating the body to exercise are beautifully effective, the adjustment cannot be instantaneous. Ordinarily about two minutes elapse before the oxygen absorption has attained the level necessary for the maintenance of the work. In short periods of exercise the work may have been finished before a breath has been taken or before significant changes in circulation have occurred. Fortunately, the actual contraction of muscle is not dependent upon

* Read at the Ninth Annual Meeting, American Congress of Physical Therapy, St. Louis, September 11, 1930.

oxidative processes and the body may accomplish the necessary work during the initial lag by incurring an oxygen debt. This implies no abnormality of the body. It is found in all exercise except the most moderate and occurs even in completely trained athletes. It has been calculated that in runners competing for records the debt may amount to 15 quarts of oxygen which is equivalent to an energy expenditure of approximately 75 calories, an amount sufficient if converted into work to lift a ton about 120 feet. When such a debt is incurred it is paid in the period immediately following exertion. During this recovery period the circulation and the oxygen absorption must be maintained at a level higher than normal for a time varying with the extent of the debt and with the individual's ability to pay.

In daily life huge amounts of work may be attempted at any time. Under the influence of haste or fright one may run rapidly and for long distances. One may deem it necessary to lift or attempt to lift enormous weights. Such efforts result in rapid labored breathing, trembling and the sensations of utter exhaustion. The question must be asked whether they are damaging to the normal heart. In his book on "The Soldier's Heart and the Effort Syndrome", Sir Thomas Lewis [3] made this statement: "The burdens imposed by physiological acts upon the heart, however heavy these burdens may be, never exhaust the heart's reserve. The reserve of other bodily structures will fail before the heart is pushed to its limits of endurance." Such data as have since been accumulated tend to confirm Lewis' postulate. Dyspnea, the difficulty of absorbing enough oxygen in the lungs, aching and stiffness of the exercising muscles, the sensations of utter fatigue, probably cause the exertion to cease before the heart has reached its maximum capacity.

Practical experience indicates that exertion cannot be undertaken with the same impunity in persons whose hearts are abnormal. Our understanding of the effect of exercise in heart disease has been greatly aided by recent studies of Meakins and Long [4]. After exertion the pulse rate and breathing of cardiacs return more slowly to normal. These investigators have shown also that the oxygen debt in a cardiac is greater for the same amount of work and, furthermore, that with the same oxygen debt the recovery period is prolonged, facts which are of the greatest practical importance and which must be kept in mind whenever exercise is prescribed for the cardiac patient. Work that is well tolerated and well within the limits of the strength of the patient may lead to great fatigue or become actually dangerous if repeated at intervals which would be entirely safe for a person with a normal heart.

The Recognition of the Abnormal Heart

It becomes urgently necessary, therefore, to recognize abnormalities of the heart before a program of exercise is prescribed. Some forms of heart disease are readily apparent. The presence of hypertension represents a double contraindication to violent effort; first, because the heart is already under strain and may become hypertrophied and dilated and secondly, because exercise tends to increase the blood pressure. A heart that is subject to valvular disease is easily recognized. Although many such hearts remain competent for the ordinary tasks of life it must be remembered that they are always laboring under a mechanical disadvantage and that their reserve and the factors of safety are diminished. Any considerable enlargement of the heart implies abnormality and indicates that the cardiac reserve has been diminished. While these groups include a large percentage of all cardiac patients, there remains a great number of individuals who show neither hypertension, valvular disease, or cardiac hypertrophy, but whose coronary arteries are affected by arteriosclerotic changes. In such individuals exercise is particularly dangerous since insufficient coronary blood flow may impair the nutrition of the heart muscle and cause serious functional changes in cardiac rhythm and rate at the time of exertion. The recognition of this type of heart disease, however, offers great difficulties. Many times a careful history may reveal the occurrence of pain in the precordium which is referred to the neck and down the inner aspect of one or both arms and which appears after relatively slight exertion. Occasionally there may be some paroxysmal shortness of breath at night. Fatigue may persist for an unduly long time after the completion of rather moderate exercise. A complaint of dizziness is occasionally encountered. In the examination of such hearts the electrocardiogram is often extremely useful in revealing grave myocardial damage and serious conduction defects which are entirely

hidden in the ordinary clinical examination. Patients with coronary disease who present neither symptoms nor physical signs on complete examination must be extremely rare. There are a few with coronary lesions who complain of questionable symptoms but who reveal no abnormality either in the electrocardiogram or on physical examination. It seems probable, moreover, that many moderate or slight coronary lesions which present no symptoms or signs with the ordinary daily activity may become evident with more violent work. It is extremely important that exercise should be undertaken cautiously in any doubtful cases and should be increased gradually and under the closest observation.

The Effect of Training

The effect of training must be considered in patients with abnormal hearts. In the absence of cardiac difficulty, repeated exercise undertaken at regular intervals causes a remarkable increase in the physical ability of a normal individual. Numerous experiments have indicated that by means of a month's training, individual groups of muscles may be made to do about three times the initial amount. Bock has recently measured the different factors in trained and untrained individuals and finds that as the result of training the resting pulse becomes slower, the output for each beat of the heart greater and the vital capacity of the lungs enlarged. Exercise is accomplished with a relatively slower pulse rate, a relatively greater output of the heart per minute and a greatly diminished oxygen debt. It also appears that the blood pressure rises to less dangerous levels even with violent exercise. The question may be asked whether similar training in cardiac patients can accomplish comparable benefits. Unfortunately there is little data available for the answer of this question. The careful observation of Schott [5], at Nauheim, and of his followers in many countries, indicate that when exercise is undertaken with careful supervision and sufficient caution the efficiency of the individual patient and his feeling of well being may be greatly enhanced.

In our study of this extremely important subject we are handicapped constantly by lack of data which in turn is dependent upon our failure to devise easily applicable and standardized tests. Studies comparing the athlete and the untrained man are comparatively numerous and satisfactory. Similar comparisons of the untrained and the pathological should be undertaken.

Lacking exact standardizations we are forced to depend upon clinical observations which after all are not entirely unsatisfactory if continued over a considerable period of time and with a variety in the amount of exertion. It has been truly said that the physician who plays golf or hunts with his patient has an immense advantage over the physician who tries to prescribe exercise after an examination in his office. Such casual but valuable information can be greatly extended by accurate records of resting pulse and blood pressure, of their increase with exertion, the time taken for return to normal as well as the rate of breathing before and after exercise. These observations should be carried out more frequently than is the custom before deciding upon definite programs of work for the individual patient. They offer excellent opportunity for cooperation between the physician and the physical therapist.

Summary

1. Exercise which is of great benefit to normal individuals may involve serious dangers if prescribed for patients with abnormal hearts or blood vessels.

2. In cardiac patients, the recovery from exercise is slower than in normal persons. Serious fatigue may result if an amount of work well within the range of ability of the patient is repeated at too short intervals and before the circulation and respiration have returned to the resting level.

3. The increased energy requirements of exercise throw a great load upon the coronary circulation. Exercise is particularly dangerous in patients with disease of the coronary arteries which is often the least obvious of all the affections of the heart. In order to reveal its presence, observations on the patient's response to exercise may be needed in addition to the most careful history and the most painstaking physical and electrocardiographic examination.

4. Although exact data are lacking, it seems probable that training under close supervision is of benefit to the cardiac patient.

5. Standardized tests are greatly needed for the study of doubtful cases. A greater degree of cooperation should exist between physicians, physical therapists and physical educators in the prescription of exercise in cardiac disease.

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Discussion

Dr. J. C. Elsom (Madison, Wisconsin): This paper is of especial interest to me because of the fact that in my work at the University of Wisconsin I am in constant association with athletes in training. I think our experience bears out that of Dr. Barr in respect to the lack of interest in the effect of athletic training on the hearts of normal individuals. Of course, it is very necessary in all athletic training to determine whether the cardiac condition of the athletes is perfectly good. The results that we have had apparently have been altogether beneficial. In fact, some of the very strenuous exercises, for instance, rowing, which had been accused, you know, of producing the so-called athlete's heart, has never with us caused any trouble. The same is true of football and basketball, which to my mind is more severe an exercise than football. We have had no cases in which there seemed to be any impairment of the cardiac function. On the contrary, we have found quite a beneficial condition.

I think the chief trouble in all athletic training is the fact that athletes, after very strenuous contests and even perhaps after the season is over, very suddenly cease their exercise and become rather sedentary in their habits. Usually their exercise is unconsciously reduced to a dangerous minimum and this sudden change of activity is where there is likely to arise injurious consequences. I think that is the crux of the trouble. Hence, we advise all our athletes to gradually taper off in their training. At the end of the season we do not allow a student to suddenly stop his physical activity but require him to take some light form of exercise and continue it for a considerable period, thus gradually reducing the physiological effects which may have occurred from his previous exercise.

I agree very thoroughly with Dr. Barr as to his advice and careful treatment and supervised training of people who have cardiac conditions. Yet I believe that there are very few cardiac conditions in which some form of exercise cannot be advantageously given, especially the slower forms of exercise, perhaps exercise taken in the recumbent position. He mentioned, I believe, Dr. Schott's method of exercise for cardiac conditions. It is a very notable work and bears out the statement he has already made.

I see Dr. McCurdy in the audience. I am sure he knows as much about this as anybody else. Mr. Chairman, if you are not going to call on Dr. McCurdy, let me suggest that he be given the floor for a few minutes.

Chairman Tarbell: For the benefit of the very few who do not know of Dr. McCurdy I want to say that Dr. McCurdy has really made, you might say, a life study of athletes and various forms of their working conditions. I know he has made extensive studies on blood pressures, heart rates and allied researches both before and after exercise. I am sure we are all interested to hear his opinions on the subject that is now under discussion.

Dr. James H. McCurdy (Springfield, Massachusettes): My work has been with the normal heart very largely rather than with the diseased heart. Whatever I have to say I think applies more particularly there. I might speak along other lines partly. I think we ought to differentiate clearly between types of exercise with reference to blood pressure. The exercises of speed, moderate speed, and exercises of strength increase the blood pressure quite moderately up to 140 or 150, and some go up to 160 or more. The exercises of strength, particularly where abdominal and pulmonary pressures are increased, are I think the more dangerous type.

Some years ago I had the opportunity with Dr. Porter of Harvard of studying the college strength tests and taking the blood pressures during the strength tests. I found some of the Harvard students during the test having pressures rising within two to four seconds from 120 to 270 mm. of mercury, and going back immediately within two or three seconds. It seems to me that there is a place where we ought to caution men of medium and older age against anything with reference to strains in lifting that requires intra-abdominal pressure increase — a thing of great importance because of the dangerous consequences. Some years before that we heard the statement that the increased pressure was due to the increase in contraction of the big muscle groups. I think we showed that was not true. We stumbled onto it in a very foolish way. In taking the blood pressures of the individuals, I found an individual when coughing had the pressure go up. I immediately asked him to close the glottis and make an expiratory effort. I found that I could increase the pressure as much as I could by lifting 500 to 700 pounds by simply increasing the intra-abdominal pressure. Then we introduced the stomach tube and took the intra-gastric pressure during the lifting and during intra-abdominal pressure, and found that the increases in systolic pressure were practically the same as the increases in the abdominal, or more specifically, the intra-gastric pressure.

There is one other line of investigation that I should like to see followed out in these cardiac cases. I suggested it last fall to the Insurance Commissioners. It is following out more specifically the differences between the horizontal and the standing heart rate, and the horizontal and the standing blood pressure, following it also with a period of recovery.

I had two illustrations, two groups of illustrations that indicate, I think, the necessity of following out some of those studies.

A few years ago I had the opportunity of following Joie Ray and Lloyd Hahn in the Madison Garden races at New York when Joie Ray equalled the mile record of 4:12. I got to him immediately at the close. I didn't get to him at the start. I found that Joie Ray's blood pressure in the horizontal position was 130 following the mile run in 4:12, which was the record. This was three or four minutes following the race.

In the standing position, immediately standing up, his pressure was 100. In other words, it dropped thirty points inside of thirty seconds simply by that change of posture. I also studied another group of mountain climbers and I will give you one illustration of a man who kept fainting on me. I could get his pressure in the horizontal position of around 110 or 112. When he stood up it would immediately begin to drop down to between 65 and 70 systolic, and he fainted on me every time. Finally I tried him in the sitting posture. It went down more slowly but still it went pretty low. He felt "wobbly". I found that if I put him on a big board, something like the lead jacket, I could raise and lower the pressure at will, simply by pressure on the board increasing the intra-abdominal pressure. You see that working out in certain practical ways, for instance with the ranchman, who always wears in the saddle a wide belt. I have talked with a number of them. "Why do you wear that belt?" I asked. They said they couldn't stand up to their work without it. I think it partly relates to the pressure and partly to the muscle.

One other thing. We followed two years ago all of the varsity football squads throughout the entire season with blood pressure readings. We found this uniform condition, not in every case, but in most of the cases: We took the pressure before the men went onto the field both horizontally and standing. Personally, I think that is very important. We ought to include both the positions with reference to gravity in every case. We found that after the men had performed strenuous work in football for an hour and a half and sometimes two hours, then had bathed and dressed and gone to the restroom and rested for a half hour, the standing pressure was still 10 to 20 and in some cases 30 mm. of mercury above the horizontal pressure. The question that I haven't solved at all is whether the difference between the horizontal and standing pressures and the time it takes to recover the standing systolic pressure may not be a good index of condition in these cardiac cases. I haven't had a chance to do that. We know, of course, from Schneider's work with aviators that in his score he puts the standing pressure 6 to 10 mm. above the horizontal for those in good condition. Of some 150 men that were in the aviation group of 2,000 men that would be considered by the doctors as not in the best condition, they did not have this plus pressure on standing.

I should like to hear from the speaker with reference to that, whether there has been some work done in that respect. I have been unable to get any outside information on the meaning of the systolic standing pressure after exercise and its return to normal.

Dr. David Barr (St. Louis, Missouri), closing: I have been tremendously interested in this discussion. I am impressed when I read over the records of athletic events to see what an immense amount of fine physiological work has been done on the normal athletes. That was pointed out, as you may know, by A. V. Hill in one of his English lectures. He said he found the Athletic Section *of the World's Almanac* the best textbook of physiological investigations of exercise that he knew about. I am sure that there are methods for the study of exercise in athletes which if applied in modified form to unfit individuals, cardiacs, and to patients with hypertension, would yield a wealth of practical information.

I am very much interested in Dr. McCurdy's remarks about the relationship between horizontal and vertical or standing blood pressures following exercise. I don't know of any study that has been made of that in cardiacs. As a matter of fact, I don't know that complete studies have been made in unfit individuals. Ward Crampton, some ten years ago, made a comparison between the horizontal and vertical blood pressures of many individuals, fit and unfit, not after exercise but simply as he found them. He was very hopeful, to begin with, that he could show a relationship between fitness and this comparison. There was none. Some very fit men showed a drop in blood pressure when they stood up and some very fit men showed a rise in blood pressure when they stood up. I don't want to go into this too much, but there are some very interesting things in regard to this comparison between standing and horizontal pressures. If a rabbit is anesthetized on a board and the head of the board is raised so that the rabbit is held in a vertical position, the rabbit may suddenly die, with a remarkably rapid drop in blood pressure. There have been five individuals studied, four by a group of us at Cornell and reported by Bradbury, and one from the Mayo Clinic by Brown, in which individuals were completely incapacitated because of this phenomenon. When recumbent they seemed perfectly normal. When they stood up their pressure fell to 40 or 50 mm. of mercury. One of these was a tabetic; the other four had no signs of organic disease.

I think that it would be possible to follow out the suggestion of Dr. McCurdy in the study of horizontal and vertical pressures in cardiacs. We are constantly handicapped in our study of the hypertensive and cardiac individuals by our fear of their disease. We don't like to have an accident happen while we are carrying out experimental exercises. Most of the exercises which have been devised for the fit individual are totally inapplicable to sick people, and no one has standardized exercise sufficiently for ill people.

COLONIC THERAPY: A METHOD OF SPECIAL DRAINAGE *

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Any radical change in therapy requires a vast accumulation of clinical data which must be substantiated over a sufficient duration of time to furnish a correct appraisal of its real value. Collectively and individually our responsibility consists in keeping our feet on the solid ground of established fundamental principles and in maintaining an open mind to anything logically built upon such ground. I believe the doctrine of free drainage to be such a fundamental principle. It is essential to normal physiology as expressed in the unhampered discharge of glandular secretion and metabolic waste. It is essential to the healing of infections, such for example as is accomplished through the drainage of infected sinuses, apical abscesses, otitis media and in all cavities confining pus in any location. And lastly it is essential to recovery from infectious diseases in general, such as pneumonia, tuberculosis, typhoid, gonorrhea, etc. Back of all this is cellular drainage, normal in physiological function, increased and altered in acute infections, and interrupted and depressed in chronic disease.

The antithesis of free drainage is stasis, a term derived from the Greek, meaning to stand. Absolute stasis of course means death. Organized motion is essential to life. Through usage in medicine stasis has come to mean impeded action and inadequate drainage, and is associated with chronic infection, congestion and sluggish function both cellular and organic. It is the basis of a large proportion of all chronic diseases. There are four regions in the gastrointestinal tract in which stasis is especially prone to occur, the determining factors being largely anatomical and mechanical. The first is the mouth, where it exists in cellular form and is expressed in terms of focal infection. The duodenum is the second region, the cecum together with the appendix and terminal ileum is the third, and the rectum the fourth.

Chronic bacterial infection is practically always an accompaniment of stasis, and may be either cause or effect. Normally the secretions of the mouth are alkaline, those of the stomach acid, and those of the small bowel and colon alkaline. With the flora normal throughout, we still find the mouth alkaline, the stomach acid, the duodenum and small bowel alkaline, but the reaction in the cecum is mildly acid as the result of the presence of an acid forming flora, while the descending colon and rectum are again alkaline. This sequence of alkali, acid, alkali, acid, alkali has at least two marked advantages,—one being that the various ferments and enzymes throughout the tract have available the reaction essential to the fulfillment of their several functions at the proper levels, and second that rotation of reaction prevents undue bacterial proliferation.

Oral and rectal infection being readily accessible receive ample consideration and treatment when present, but not as a rule until they have existed long enough to initiate stasis with accompanying infection in other parts of the tract. With the physiology of the stomach and duodenum normal it is rare for infectious material from the mouth to gain a foothold in these parts primarily. Activity is too great, the current too swift and drainage too free. Conditions in the cecum however, are much different,—the current is sluggish, activity intermittent, drainage incomplete and bacterial growth a normal process. For these reasons I believe the cecum to be of vast importance potentially as a master focus [1], second only to the mouth, and once infected of even greater importance.

In speaking of the cecum as a focus of infection I do not refer to the condition occurring in the normal healthy bowel in which a proper balance between aciduric and putrifactive bacteria exists, and in which the mucous membrane is intact, the defensive mechanism perfect and drainage adequate. I refer to a condition of cellular stasis accompanying the activities of a predominating putrifactive or purulent flora with excess production of toxins, depressing cellular function and leading to mechanical stasis, inefficient drainage, breaks in the continuity of the mucous membrane and failure of the defensive mechanism. This condition exists far more commonly than is generally supposed, and is the

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sine quo non of acute appendicitis.[2] Chronic tenderness over this area leads to many operations for chronic appendicitis, less than 50 per cent of which are actually justified. Cecal stasis [3] is the underlying cause of many cases of chronic constipation, colitis, adhesions and the symptom-complex known as intestinal toxemia. This, however, is not all. We know that toxins and bacteria pass through the damaged mucosa, enter the portal circulation and in a period of years injure the liver [4], producing a hepatitis [5] and ultimately gall-bladder disease. Beyond the liver as we shall see they are to be held accountable for disease in practically every tissue of the body.

A few years ago Braithwaite [6], of Leeds, England, made some very interesting observations on inflammatory processes in the right iliac fossa and carefully traced the lymphatic drainage from this area. He checked these observations by experimental work both on cats and on the cadaver, and demonstrated that the normal drainage from the ileocecal angle followed a chain of glands along branches of the superior mesenteric artery to the lumbar group of nodes lying just above and behind the third portion of the duodenum and then directly into the receptaculum chyli. However, some of the lymph was found to pass upward over the head of the pancreas to enter that group of glands which frequently lies in a crescent or in a series of small groups along the inner border of the curled duodenum. Some was even found to pass through this group on to the duodenal wall, itself, and up to and occasionally beyond the pylorus. On two occasions the dye was followed to the chain of glands along the common bile duct and even to the cystic gland. Braithwaite found that in chronic infections the lumbar group was frequently blocked and that drainage from the ileocecal angle almost uniformly reached the subpyloric and right gastro-epiploic group. Drainage through the great omentum was also shown to reach these groups.

Although the conclusion was reached that without retrograde or aberrant flow lymph can never reach the duodenum, nevertheless, evidence brought to bear on this subject by many independent workers leads one to the belief that the large groups of glands lying on or near the head of the pancreas with the group on the superior mesenteric trunk, act normally as one big receiving station; with extensive backward and forward communications within the limit of the station: something analogous to the circle of Willis at the base of the brain, allowing lymph, hindered in its flow in one direction, to pass in another. Following this line of reasoning Braithwaite [6], Wilkie [7], Moynihan [8], Mayo, Murphy, Deaver [9] and others have admitted the possible casual relationship between infections in the region of the cecum and inflammatory processes in the neighborhood of the duodenum, including gastric and duodenal ulcer, gall bladder disease and duodenal stasis. Moynihan [10] recognized three gastric stigmata which enabled him to diagnose a diseased appendix almost with certainty while it was still out of sight in a series of over 1000 abdominal operations. These stigmata were,—(1) pyloric spasm, (2) pyloric congestion, (3) enlargement of glands on the greater curvature of the stomach toward the pylorus. In my own work I have frequently demonstrated acute tenderness over the pylorus in conditions of cecal stasis where all the symptoms were referable to the colon and the lower right quadrant. From the evidence just reviewed it would seem logical, then, that a large proportion of pathology about the duodenum is secondary to stasis in the region of the cecum.

Furthermore, it is not generally appreciated that the duodenum is the most sensitive part of the gastrointestinal canal with the sole exceptions of the mouth and anus. Chronic inflammatory processes in the cecum and colon may be entirely free of local symptoms at a time when associated duodenal stasis and secondary foci in the upper right quadrant are demanding a great deal of attention. It is rare indeed that colon or cecal stasis in the absence of appendiceal involvement or colitis directs one's attention to the actual seat of the disease. It is a silent area but none the less a potent one.

The various methods of treating cecal stasis in the past have been manifestly inadequate and disappointing. The vast array of methods and means that have been attempted and ultimately found lacking are ample proof of this: catharsis, intestinal antiseptics, colon irrigations, resection of the cecum as practiced by Lane, transduodenal lavage, colostomy with lavage and others. The method I have been using for the past three years and

one which has given perfect satisfaction in my hands is a method founded on the principle of free drainage. It has been built up around the technique of colonic therapy as introduced by Schellberg [11] with the addition of such other rational procedures as appeared desirable. Superficially this technic appears to be just another method of colon irrigation. The apparatus however was designed to meet very difinite needs and so far as I know no other method can fill the requirements as well. As the result of years of study, research and experimentation in the fields of mechanics, bacteriology, chemistry, and therapy Schellberg arrived at the conviction that the keynote in colonic therapy was drainage. It was he who first conceived of the colon as consisting of two functionally different segments, the absorptive and the motor [12]. He found that the only way to relieve stasis in the cecum was to have it emptied, hence he developed an apparatus and a technique by which he was able to reach it in at least 95 per cent of cases. This is accomplished by passing a 52 inch tube through the colon directly into the cecum [13].

Bearing in mind that our primary object is free drainage without traumatizing the tissues, it is necessary to develop skill and speed in advancing the tube together with an educated touch that guarantees manipulation with extreme gentleness [14]. The experienced operator is able to pass the tube to the cecum in less than five minutes as a rule, without the use of force and with absolutely no discomfort to the patient. No attempt is made to wash out the colon as the tube is introduced, but it is passed at once to the cecum which is partially emptied of material and a hot medicated solution deposited. The apparatus embodies three irrigating jars with independent valves, one of which contains tap water at body temperature for advancing the tube, the other two containing medicated solutions at 50 degrees C. The value of using these solutions at this temperature is that the heat relaxes spasm, destroys a great many bacteria, stimulates the circulation of blood and lymph, and stimulates muscular contraction.

We seldom use the same solution two days in succession, alternating acid with alkali as much as possible. Every solution is used with a definite object in view:[14] sodium carbonate to soften and loosen mucous, neo-silvol as a mild antiseptic and local sedative, acid sodium phosphate alternating with an alkaline sodium phosphate, sodium salicylate mixture for active drainage, sodium thiosulphate as a mild antiseptic and diuretic, potassium permanganate and zonite in very dilute solutions for mild antisepsis, and finally Acidophilus and Bulgaricus cultures for implantation. We avoid antiseptics and irritating solutions as much as possible, making use of very mild solutions only once or twice in a complete series, because we can accomplish more and with much less damage to tissue by the use of hot, mild saline solutions than by any other means. These treatments are not exhausting and we find that patients can continue to take them twice weekly almost indefinitely.

As we have seen that cecal stasis may produce pathology in the right upper quadrant, so also we might expect drainage and relief of cecal stasis to be an important step in correcting pathology higher up. This is actually the case, for with the disappearance of irritation and congestion at the ileocecal angle the normal gradient is restored and duodenal stasis is relieved. Furthermore, toxins and bacteria cease to be carried to the liver by the portal circulation and to the subpyloric and gastro-epiploic glands by the lymphatic system, and in their place we have cleansing and healing solutions bathing these tissues.

Naturally enough the question arises as to the advisability of using this route for other forms of medication. There is no doubt at all but that this is possible and in selected cases very desirable. On the other hand, of course, it has its limitations. The oral route will always continue to be the popular one as it is the simplest. Hypodermic and intravenous medication will also continue to hold their ground. However, there are some things that can be accomplished by colon therapy that cannot be done as well in any other way.[15] Among these are: complete cleansing of the colon from the cecum down, direct application of medicated solutions to foci of infection high up in the colon, establishment of free drainage at the ileocecal angle, the promotion of absorption of recent peritoneal adhesions, the breaking up of interlining adhesions and the promotion of increased activity of the colon, itself, with cure of chronic constipation.

Secondarily, I have observed the following results from the use of colonic therapy alone

in my private practice: complete cure of chronic cases of pyelitis; complete cure in certain cases of leucorrhoea; complete relief in many allergic states such as asthma, urticaria, eczema, migrain and vaso-motor rhinitis; also many toxic states such as lumbago, sciatica, neuritis, hypertension, low blood-pressure and anemia. Furthermore, I have observed beneficial results in cases of arthritis, sinus infection, bilious attacks, chronic indigestion, neurasthenia and others.

Occasionally I have had cases of long standing in which extended treatments have apparently accomplished nothing. Bilious attacks continue to recur. Colitis and constipation are relieved only to reappear a few weeks later. Anemia, arthritis, neuritis, or other attending conditions hang on tenaciously. Shifting pains in the abdomen or back, occasional headaches, attacks of indigestion, mental and physical depression, all alternating with brief periods of an unusual sense of well-being is the picture usually presented by these patients. They are the cases that tax one's faith and ingenuity. Many of them have had one or several laparotomies. Many are neurasthenic and arouse the suspicion that they rather enjoy poor health. With these patients I "go the diagnostic limit," but through it all I continue one or two colon treatments weekly.

I find I am using diathermy more and more frequently in these cases. It appeals to my good judgment as being an excellent means of increasing and assisting free drainage, and in actual practice has apparently justified this judgment. It unquestionably relieves pain and the patients appear to improve much more rapidly with its use. I frequently follow this with mild sine wave treatments as these produce muscle contraction and thereby assist cellular drainage. The ultraviolet rays are used to build up immunity and also for their tonic effect.

Supportive and other therapy is brought to bear according to indications. Rest, diet, environmental change, tonics, sedatives, alteratives, the intravenous use of sodium iodide and of iron and arsenic, mineral waters, baths, massage and ptosis supports have all been used. Occasionally there have been strong indications for performing a laparotomy and in such cases it has been advised. On the other hand it is surprising what can be accomplished by the above outlined course of treatment, alone, when conscientiously and persistently carried out. Many times have I seen cases under treatment for months take a sudden turn for the better and ultimately present the picture of a complete clinical cure and maintain it. I have learned that it does not pay to give up. These are the cases that have been "the rounds", and this is their last hope of regaining normal health, so most of them will cooperate with you providing they receive the proper encouragement. As they have been a long time in acquiring this condition they will require a long time to get over it. As I see it the secret in managing these cases is continuous, persistent, active organic and cellular drainage of diseased tissues until the normal physiological balance has again been restored.

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60 Exchange Street.

Third International Congress of Radiology Paris "la Sorbonne" 26-31 July, 1931

The Third International Congress of Radiology will take place in Paris from July 26th to 31st, 1931, under the High Patronage of M. le Président de la République, the Honorary Presidency of Madame Curie and the executive Presidency of Dr. Antoine Beclere.

All Congress Meetings will take place in the amphitheatres of "la Sorbonne", 47 rue des Ecoles.

Congress Committee—

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Congress Program—

Sunday, July 26th—Meeting of the Delegates of the 26 countries officially represented.

Opening of the Exhibition of Electro-Radiological Apparatus. Welcome Meeting with dance.

Monday, July 27th—Opening meeting of the Congress in the "Grand Amphitheatre de la Sorbonne", in presence of M. le President de la République.

Beginning of work of the Sections.

Tuesday, July 28th—Question of the day to be discussed and work of Sections.

Evening at the Opera.

Wednesday, July 29th—Question of the day to be discussed and work of Sections.

Visit to the Exhibition of Apparatus.

Thursday, July 30th—Question of the day to be discussed and work of Sections.

Subscription Banquet.

Friday, July 31st—Work of Sections.

General Closing Meeting of the Congress.

Night festival at the Colonial Exhibition.

Questions to be Discussed—

During the opening meeting Professor Forssell (Sweden) will speak on: "Social Struggle Against Cancer".

Four questions are to be discussed at the Congress, each one will be given out in a thirty minutes lecture at the General Meeting, all Sections present, by the following authors selected by the Radiological Societies of their respective countries.

Dr. Cole (U. S. A.)—"Radiological examination of the mucosa of the digestive tract."

Dr. Lynham (England)—"Pre and post operative treatment of cancer of the breast by radiation (recurrency and metastases excepted)."

Pr. Haenisch (Germany)—"Radiological examination of the urinary apparatus by excretion of opaque substances".

Pr. Milani (Italy)—"Radiotherapy of inflammatory diseases".

Communications—More than 300 communications are announced. They will be divided between the six following Sections.

1. Radiodiagnosis.
2. Roentgen & Curietherapy.
3. Radio-Physics.
4. Radio-Biology.
5. Electrology.
6. Natural and Artificial Heliotherapy.

The congressists will receive a volume containing the summaries of 300 communications before the Congress.

Commission of Measures—The Commission of measures, where each of the 20 principal countries is represented by a physicist and a physician, will continue the work begun in Stockholm on International unification of measures.

Exhibitions—An Exhibition of books and of radiological publications is organized on the Congress premises at "la Sorbonne". Demands to be addressed: Librairie Masson, 120, Boulevard Saint-Germain, Paris (7e).

An Exhibition of electro-radiological apparatus is also organized at "La Porte de Versailles".

Entertainments—The Titulary and Adjoined Members of the Congress are invited to the three following entertainments:

1—Welcome Meeting with dance on Sunday, 26th of July.

2—Opera evening on Tuesday, 28th of July.

3—Night festival at the Colonial Exhibition on Friday, the 31st of July.

A subscription Banquet will take place on Thursday, the 30th of July.

Ladies' Committee—A Ladies' Committee will organize excursions in and around Paris and visits to museums for Adjoined Members of Congress. The Congress Members will

(*Continued on page 306*)

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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E D I T O R I A L S

SUNSHINE AND CIVILIZATION

Civilization was nurtured and cradled in the tropical and semi-tropical regions of the globe, such as China and India, Babylonia and Assyria, Palestine, Greece and Rome, and in Northern Africa. The newer and more modern civilization moved northward and finally established itself in the temperate zone, an area in which temperature and climate were by no means the ideal for the attainment of optimal health.

The newer civilization is a very vital and rapidly advancing civilization. The individual has gained much from it. It has relieved him from the task of pitting his mere physical strength against the forces of nature. It has magnified through the microscope and the telescope his vision and has revealed to him undreamt-of worlds. Through implements and machinery it has miraculously augmented his physical capacities. Through the invention of the steamship, the automobile, and the aeroplane, and wireless communication, it has annihilated time and space.

The benefits derived in a material way brought also disadvantages in other directions. The most obvious disadvantages lie in the realm of community hygiene and personal health. Up to about a hundred years ago the mode of everyday living remained practically the same for many centuries. Then came the industrial revolution. Great masses of men and women and children came out of the open spaces from the farm, the hamlet, and the village, crowded into very limited areas, and built up cities with populations estimated into the millions. The great mass of mankind left the open sky and the sunlight and started life huddled and crowded and gradually drifted away from the external and beneficent forces of nature.

The newer civilization was ushered in by industrialization, which in turn compelled urbanization. Industry poured smoke and dust into the atmosphere and aggravated still more the unhygienic influences of already existing unfavorable climatic conditions. Urbanization developed overcrowding and homing conditions which allowed a minimum of contact of such an external energizing force as sunlight.

The north temperate zone, the hub of the newer civilization, also became the center of the sun-deficiency diseases, — rickets and tetany.

Modern science in this newer civilization has done very effective work through discoveries in bacteriology and immunology in the direction of ridding the world of some of the dreadful infections, like smallpox, yellow fever, typhoid fever and diphtheria. Modern science has not yet successfully coped with the diseases of the north temperate zone, the respiratory diseases, such as the common cold, influenza, sinusitis, tonsilitis, laryngitis, bronchitis, pneumonia and tuberculosis. We can never hope to eradicate these respiratory diseases if we do not take into account the important fact that the sun-deficiency diseases,—rickets, tetany, and osteomalacia,—predispose to pneumonia and tuberculosis as well as to other diseases of the respiratory tract.

In certain parts of the world where remnants of the older tropical civilization still persist, as in India, there developed time-honored but artificial sets of social rules for the regulation and guidance of the conduct of the individual. These rules were far from being conductive to health. The Hindu women of higher caste and the Mohammedan women practice seclusion or *purdah*. They keep themselves indoors in houses with meager facilities for exposure to sunshine or for its infiltration. On the rare occasions that they do venture out, the greatest portion of the face remains covered. Osteomalacia is common in India. The disease occurs among women and rarely among men, because it is the women who are confined, while the men have access to sunlight. The lower classes in India who do not practice *purdah* have comparatively few cases of osteomalacia. It may be mentioned that wherever osteomalacia prevails rickets and tetany also abound, and this fact is true for India.

Levine's studies, published elsewhere in this issue, point out that the sun-deficiency diseases bear a definite relation to the amount of sunshine hours available and also to its quality and intensity. Glasgow and London have very little sunshine and rickets is very common in these two cities. Russia is a great center of rickets. One can hardly conceive why London with its fogs, Vienna with its overcrowding, and Leningrad with its cold, wintry and sunless days, should have become such important centers of human activity. The relation of rickets, tetany and osteomalacia to sunshine hours and to intensity and quality of sunlight hours, however, does not often hold. Levine explains that lack of relationship is to be noted in areas of dense population where overcrowding must necessarily occur, as in Vienna, or in areas where racial and national custom or personal habit leads to a life away from sunlight. In Algeria, land of sunshine, rickets prevails in the indigent and dark quarters. In India, rickets, tetany and osteomalacia are to be found among the upper classes because of the practice of seclusion. Children may be kept indoors for too long a time because of cold weather or because of the existence of a state of subnormal health. In the West Indies, islands of sunshine, rickets exists because the mother is in the habit of leaving her baby at home, while she goes out into the sunny fields to do her day's work.

Civilization must go forward. It cannot retrogress. To continue in its progress it must learn to do for the individual in relation to his health what it has done for the individual in relation to his material advancement. It must correct the weak points in its structure and must devise ways and means of removing and preventing objectionable features. Already we are beginning to make our mode of living more hygienic. Rickets and tetany and osteomalacia are becoming milder in their manifestations, due to the prophylactic measures which are now being universalized, and there looms large the hope of their complete disappearance. Cod liver oil has become a household word. The sunbath is beginning to be used as often as the old fashioned bath. Our housing conditions must be improved to allow a greater influx of the potent rays of the sun, and we must learn once more to become a race of outdoor men, women, and children.

To quote from Levine, whose scientific mind is tinged with a sense of the poetic:

"Civilization is a great gain, but it is also the mother of prevailing ill health. It is the house, the office, and the workshop that are doing great harm to us. We have developed a race of men who fear the skies. We do not make sufficient contacts with nature. We are too much cooped up and locked in by walls and ceilings. We transact our business,

we learn our lessons, we write our songs and our poems and our books under ceilings. We paint our pictures, we twang our lutes, we eat our food, we get our pleasures in pent-up places. We make our loves and dream our dreams cramped in by walls on all sides. We therefore lose the fullness of spirit that comes with perfect health, and we lose that largeness, that calm majesty and that universality with which the skies and the heavens fill our soul.

"Humanity, democracy, universal brotherhood, and the one God—these precious concepts have come to us down the ages through the teachings beneath the heavens. Moses gave the ten commandments under a flood of sunshine. Buddha preached under the open sky. Christ taught in the open, in the field, in the valley and on the hill lighted by the sun."

COMBINING OCCUPATIONAL AND PHYSICAL THERAPY

Institutional practice of physical therapy is becoming more complex in proportion to the increasing demands placed upon it. There was a time when many of the measures now numbered as a part of the whole discipline were operated independently of each other and were considered by these disciples as all important. Each of these groups fully believed in their own sufficiency and honestly considered themselves the most essential part, if not the whole, of what is now clasified as physical therapy. Consider the situation of a few decades ago. Hydrotherapy had reached the apex of its popularity and every progressive institution had somewhere in its basement or in some other inconspicuous place a department of hydrotherapy. Its importance was at times totally exaggerated. The popularity of some of our well known watering centers was in a great measure due to the misconception of the mysterious qualities inherent in the water. The continued life and popularity of these watering places is today dependent upon other features than the therapeutic uses of the water.

The modern physician utilizes all the important advances in physical therapy as well as other fundamental measures necessary to overcome the affection under his consideration. The patient now receives a thorough examination, blood or serologic and laboratory tests, x-ray, and, where indicated, proper medicinals, a selection and limitation in his diet, the water cure, massage, exercise and photo- and electrotherapy and, in some of the more progressive places, the needed occupational therapy to stimulate his morale and to re-educate the lost function of a part.

Physical therapy fell into disuse a few decades ago on account of the disorientation that developed between the physical and the pharmacologic side of our therapy. Classical medicine began to listen to the insidious whisperings of misunderstanding and disappointed practitioners. The physician who had purchased, for example, some single physical therapy apparatus and had hoped, somehow, to cure all of his difficult cases, eventually suffered the disappointment that was logically bound to follow a premise so unstable and immature. The cumulative effect of many such disappointments resulted in a wholesale distrust of each and all of the measures associated with physical therapy. Even today, static electricity has not lived down the unjust reputation that it is nothing more than a psychotherapeutic measure. Such is still its major reputation in all of the medical centers in America with the exception of a small area in the New England states.

What has been said of static electricity can in a like manner be said of some of the other measures that were so popular and so prevalent several decades ago. Galvanism, massage, or hydrotherapy, each used by itself, has often fallen short of its expectancy. Nor is assurance certain that with the addition of the more modern innovations, such as diathermy and phototherapy, that physical therapy has reached the stabilizing place in the scheme of modern therapy. There has heretofore been lacking some inexplicable feature in this broad field that none of the special measures have been able to cover. Although it is true that many spectacular cures have been accomplished by these means, it has also been observed that a definite number have either not improved or have improved up to a certain degree.

Molander's[1] paper which is printed elsewhere in this issue opens up a new avenue of possibilities. The partial failures that have heretofore been observed to occur in connection with physical therapy have often been due to a lack of orientation with some other form of reconstructive therapy. The recent world war fully demonstrated the possibilities

of Occupational Therapy. Not only has its field of usefulness been extended to functionally disabled parts, but it has been utilized as a liaison therapy to the bed-ridden, and to a host of other patients who tend to develop psychoneurotic manifestations because of the tedium of sickness and to unhealthy introspection regarding their physical state. The experiment carried out at the Michael Reese hospital, in Chicago, under the supervision of a physician thoroughly experienced in both methods is a step in the right direction. That it has turned out to be a successful experiment is a point of encouragement for physical therapy in general and should be adopted more universally as an active part of our discipline.

The purpose of Occupational Therapy is well defined in the following statement by the Boston, Massachusetts, School of Occupational Therapy. "Occupational Therapy aims to furnish a scheme of scientifically arranged activities which will give to any set of muscles or related parts of the body in cases of disease or injury, just the degree of movement and exercise that may be directed by a competent physician or surgeon. Stimulating heart action, respiration and blood circulation accurately as prescribed, and at the same time it yields some of the joy and satisfaction that wisely selected, wholesome occupation provides in normal life. It thus takes its place with nursing, medicine and surgery as one of the important departments of medical art." It is a means of overcoming some of the residual pathologies encountered. "The patient," says Kidner,[2] "is aided in mobilizing his physical, mental and spiritual resources for overcoming his disability. The tedium and consequent depression occasioned by the enforced idleness of illness are relieved, suffering is diminished, the care and management of the patient present fewer difficulties, convalescence is hastened and the danger of relapses, invalidism and dependency is reduced."

Occupational therapy offers physical therapy an additional means in reducing some of the tenacious morbidities so often encountered in its experience. The increasing demands placed upon the physical therapy service in the average progressive institution is such that unless it becomes more flexible in its method there is likely to be seen another decline in its popularity.

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ALBERT ABRAHAM MICHELSON

The world has lost in the death of Professor Albert Abraham Michelson its most distinguished and gifted leader in physical science. Throughout the world the news of his passing has evoked an unusual expression of sorrow and sympathy. His intellectual achievements have long been evaluated by contemporary critics as among those most original and valuable to civilization. The world of science had regarded Michelson as one of the greatest geniuses of the ages. While his fame will for all time be coupled with his contributions in determining the speed of light and the radius of the red star Betelguese, his was a manifold intellect that manifested its rare qualities in many other endeavors.

The unusual is perhaps to be expected in personalities that are so rarely endowed. Michelson had no eccentricities. He was the most profound intellectual among that unusual group that was gathered together to form the initial faculty of the University of Chicago. The writer, a former pupil, recalls the many sided talents of this brilliant teacher. His teaching was always methodical. It was so simple and painstaking that it reduced the problems under discussion to the simplicity of ordinary events. One never saw the burden behind the simple exposition. He was neither absentminded nor emotionally eruptive, although the time we write of was during the period when the distinction of the Nobel prize was still resting, one imagined, with unaccustomed weight on his reputation. He was as meticulous in dress as he was in his method of presenting the facts of a certain problem. There was a nonchalantness about the entire personality of the man, a quietness of address, that was altogether disturbing in the light of the tremendous reputation that traveled ahead of him. He was apparently master not only of the vast problems under his supervision but he was also master of his emotions, to the point

where one at times sensed the tension of the rigid self-control that he voluntarily imposed on himself. His voice ever held that soft low level quality that often is spoken of as flat. In his eyes, however, one observed and sensed the fervor of an unusual intellect. They shone brightly and they sparkled crisply.

In whatever undertaking Michelson's interest became focused, in that field he always excelled. His athletic prowess was above the average and he maintained his superiority to an age that is often spoken of as decrepit. His prowess at billiards is still a remembered event at the Quadrangle. He was an exceptional tennis player and played an active game until long past the allotted span of three score years and ten. As an artist he enjoyed the distinction of having received unusual honors for his original oil paintings of landscape scenes as well as for his proficiency in music. He preferred to paint rather than visit art galleries. He preferred to play the violin (and well) rather than hear others play. It was said of him that he did all things well, despising mediocrity wherever he found it and enjoying proficiency more than its reward.

Dr. Michelson was born in Strelno, Germany, in 1852, and came with his parents to the United States as a very small child. It was upon American soil that his talents were nourished and blossomed out as genius of the first order. He was graduated from the United States Naval Academy and then became a faculty member of that institution. His interest in physical problems forced him to seek higher seats of learning in countries such as Germany and France, and his researches brought him honors from various universities. In 1892 he became associated with the University of Chicago as full professor and head of the department of physics, a connection which he retained until his resignation a year ago. His most important work on the speed of light was done in the foregoing university, and in 1907 he was awarded the Nobel prize, the first American to receive this distinction. In his seventy-ninth year the crowning achievement of his life's work was reached. Physically weakened but mentally as alert as in his younger days, the final experiment of measuring the velocity of light was finished. On his death bed, just when consciousness was gently slipping away from the body that had already ceased its activities, with eyes dimming to the light of the world, his ears were yet able to hear the tidings that his last experiment was a success. What a dramatic ending!

The news of his death has elicited world-wide comment. Einstein's appreciation of his venerable colleague is expressed in the following tribute:

> In carrying out physical experiments Dr. Michelson was an artist of the highest type.
>
> His invention of the interferometer, his celebrated attempt to discover the earth's motion through ether, which was a precursor of the enunciation of the principle of relativity, the diffraction method for determining the diameter of stars, the proof by purely optical methods of the rotation of the earth, and, finally, the wonderfully exact measurements of the velocity of light, all these feats of experimental skill will be admired as long as mankind concerns itself with physics.

Of the numerous editorial comments that have recently been written regarding the accomplishments of this man, none has crystallized his personality so well as that recently published in an outstanding Chicago paper.* It says:

> Dr. Albert A. Michelson had the supreme satisfaction of life work to the finish. His body failed him very little and his mind not at all. Thus to him living was a perfectible scheme, not thwarted and defeated by its inherent defects, by frustration and the inadequacy of the person to the event, but possible of continuous development with the present richer for the past and the future always one of promise. It was suitable that a rare mind should have this rare experience. One such life is more than what it contains for the gratification of its possessor. It may be only a portent for the lesser people, but it is nevertheless an accomplishment for them all. The highest flight of life reveals its possibilities.
>
> The completeness of Dr. Michelson's life was beyond normal expectation just as his achievements were beyond normal understanding. That is its dramatic quality, greatness in unspoiled symmetry.

Probably no other group in the medical profession has held the name of Michelson in greater esteem and respect than that of the physical therapist. Their closer interest and study of the forces of nature, particularly light, has given them a deeper appreciation of the contributions of this great man and the loss that the world has sustained in his death.

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* Editorial: A Great Life, *Chicago Tribune*, (May 11), 1931.

PHYSICAL THERAPY CLINICS

VITAL ULTRAVIOLET LIGHT EXPOSURES: WITH ESPECIAL REFERENCE TO THE HEALTHY PERSON

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The general confusion that exists at present in regard to the value of ultraviolet, and the usefulness of the various types of lamps can be made more clear if we would realize that we have two distinct features to study. The first of these has to do with the measurable, repeatable, specific effects of definite wave lengths of the ultraviolet. The second considers the general clinical evidence of exposure to the many wave lengths of infra red, visible light, and ultraviolet from types of apparatus available to the physician and to the public.

The conditions in which the use of specific wave lengths of ultraviolet are proven, measurable, and repeatable have been few. The laboratory is required for this work, and few clinicians have been fortunate enough to have associated themselves with the physicists who have the laboratory apparatus available. Some day special monochromatic sources of ultraviolet energy of sufficient intensity will be available for the use of clinicians so that they can repeat specific wave length experiments. I shall name the few specific reactions of specific wave lengths: erythema (sunburn) production; direct antirachitic action, i. e., activation of nonactive ergosterol sources; and detoxification of pernicious anemia blood serum. The first two of these are problems for the physician and for the hygienist. In our modern age, the lay person has accepted the spectacular results of erythema production and antirachitic effects, and is using ultraviolet apparatus designed for the home.

The second feature of ultraviolet light exposure which we must consider is the general clinical evidence. The ultraviolet light sources have been mercury vapor arc in quartz and various forms of carbon arc or flame lamps. Clinicians throughout the world have reported favorable results which warrant the continued use of such apparatus in many conditions of illness or breakdown of the body machine.

No specific wave lengths have been uncovered for the reputed action of clinical sources of ultraviolet on raising the hemoglobin; increasing the bactericidal power of the blood; prevention of the "common cold"; or curing tuberculosis. The evidence for these and possible other effects has depended on the observer or else on the other factors as an established regimen, proper food, rest, exercise, fresh air, and encouragement. Persons with tuberculosis of non-pulmonary organs and tissues thrive during the period of ultraviolet radiation from sources clinically available if that period includes an anti-tuberculosis regimen of existence. Tuberculosis of the skin has shown marked improvement with general tonic care and hygiene plus local and general radiation of the patient with the mercury vapor arc in quartz air cooled lamp.

There is evidence available that tuberculosis of non-pulmonary organs and tissues responds to treatment formulas which do not include ultraviolet radiation, that is ultraviolet radiation of the quality and quantity emitted by high noon sun. Excellent results have been reported by Sir Henry Gauvain when he used sunlight and sky-shine of weak intensity; but the patients were under definite control. What this indicates is that the published results in the treatment of the non-pulmonary forms of tuberculosis must depend on some factor outside the measurable, repeatable, specific wave length mentioned above.

So far this discussion has considered the treatment of the definitely pathological cases with which the physician ordinarily is well acquainted. How does this influence the

rationale of exposure in the home? Self-treatment with emission from artificial sources of ultraviolet has the same pitfalls and dangers as self-treatment with any other measure, for example, drugs or sunlight. A physician prescribes the drugs he expects to aid his patient to recovery; he may in a like manner prescribe physical measures.

The person in good health anticipates continuing in good health, and in recent years he has been taught that living in sunshine is conducive to such continued good health. Artificial sunlight is offered to him. It is offered without definite data as to what portion of sunlight, or how much of that portion of sunlight can reasonably be expected from the apparatus under normal operating conditions per unit of time. There could be no objection to the general sale of such apparatus if each piece carried a certificate of its emission characters—quality and quantity per unit of time in some measure acceptable against standard. The Bureau of Standards of the National Government has established standards of ultraviolet emission and will measure apparatus submitted to it.

The Council of Physical Therapy of the American Medical Association has also set up standards and specifications for ultraviolet emanators. It examines as well as passes upon apparatus submitted to it for advertisement in the pages of Hygeia. The standards and specifications of the Council of Physical Therapy should be acceptable to all manufacturers and medical advisers. The Boards of Health of state and city should include these standards in their sanitary codes, and permit only that apparatus for sale in their jurisdiction which carries a certificate that it meets these standards.

Such courses, as outlined, would not give any official or medical approval of the apparatus for treatment of diseases. Nor would it be a sanction of sanguine promises for preservation of health. A review of the opposing evidence on cold prevention is pertinent in this paragraph. One school reports favorable results, yet another equally efficient group of investigators reports no difference in the incidence of colds in radiated and non-radiated children. Further, one source of ultraviolet clinically available has been claimed to be better than another source in the reduction of the incidence of colds among healthy persons radiated; but another physician reports that neither source used by him was effective in cold prevention.

The administrators in charge of health conditions in their communities are interested in the possible damage which ultraviolet radiation can cause in the home without medical supervision. There is no evidence anywhere available that any lamp for the emission of ultraviolet has harmed anyone by reason of its radiation. There are persons with sensitive skin who react to radiation from any ultraviolet source, including natural sunlight. The number of such sensitive persons is very slight. Very few cases of such light sensitive persons are reported, and if one were to forbid or condemn the artificial ultraviolet sources on their account, one must also forbid or condemn sunlight. There are also instances wherein drugs or perfumes made from coal tar derivatives have been used by persons who subsequently on exposure to ultraviolet radiation from sunlight or artificial sources became ill or developed a dermatitis. Such ill results have included skin pigmentation, urticaria, general malaise, and inflamed joints. Again, the number of people who react in this manner is very small, so that as they are encountered the findings are reported in medical journals as rarities.

Practically, therefore, the contraindications for the use of sunlight, and of ultraviolet available from artificial sources by the well and healthy are insufficient to warrant a blanket refusal to sell apparatus of this kind. Hundreds of machines have been sold within the past few years for use by the well and no harmful results from the radiation have been reported. There remains the possibility that a supposed healthy person is suffering with some form of severe illness and yet be ignorant of the gravity of the mild symptoms which impel him to try ultraviolet radiation. The risk is taken if a dose of castor oil is taken for a stomach ache which introduces acute appendicitis.

In so far as the literature of counterindications for radiation with ultraviolet is concerned, much is based on guess work and hearsay. Any statement of such counterindications would be open to severe criticism. Counterwise, any blanket statement as to the results obtained or obtainable through exposure to radiation from clinical sources of

ultraviolet radiation by healthy adults would also require support by unbiased experiment under control conditions. Thus, offering ultraviolet radiation alone to adults of congested tenement districts would be wasted effort, for it would not take the place of necessary food. Adults have been specified because it is not yet determined whether full grown persons partaking of normal, mixed diet need ultraviolet as supplied by artificial sources. This implies that the day at the beach or in the country under the sun includes other factors in addition to the sun's ultraviolet which leads to the feeling of well being, the refreshing of the city man and woman on summer vacation.

This discussion is made with the hope that it will indicate that the explanation which will cover all the reactions recorded in clinical experience with ultraviolet in human biology (and pathology) awaits discovery. The question may well be raised if we have any valid explanation for any reaction. The lack of such explanation in no way invalidates the results which are daily being accomplished by radiation with ultraviolet sources. The apparatus available to the physician for ultraviolet radiation is an added tool. It has proved its worth, and the empiric clinical results have initiated physical and chemical studies which have substantiated those results in a few instances. In other instances, laboratory substantiation is still lacking.

I wish at this time to review the physiologic concept of VITAL ultraviolet which I first proposed a few years ago.

Formerly the physicist divided the region of the ultraviolet into the near, middle and far ultraviolet. As a physician interested in physiology applied to medicine, I proposed a division of ultraviolet more in accord with human biology. I took two places in the ultraviolet: one, the limit of natural sunlight (at 2900 Angstrom units); and two. the conventional barrier of glass to ultraviolet (at 3200 Angstrom units). The divisions which I proposed are:

INTRAVITAL ULTRAVIOLET: from 3900 to 3200 Angstrom units which represents the ultraviolet which passes through ordinary window glass;

VITAL ULTRAVIOLET: from 3200 to 2900 Angstrom units which represents the ultraviolet present near noon in summer sunlight which does not pass through ordinary window glass;
EXTRAVITAL ULTRAVIOLET: from 2900 Angstrom units to the limit of penetrability of air of ultraviolet being about 2000 Angstrom units.

The zone of VITAL ULTRAVIOLET from 3200 to 2900 Angstrom units includes the specific ultraviolet wave lengths of antirachitic value and erythema production. The VITAL ULTRAVIOLET zone includes the specific zone which affects calcium and phosphorus metabolism. This zone has some of the wave lengths which act on the precursor of the antirachitic vitamin in otherwise nonactive substances.

I am certain that there must be a threshold intensity for VITAL ULTRAVIOLET for effective ultraviolet therapy. Only future studies will determine the threshold requirements for effective dosage. Upon the answer to the question, does prolonged exposure of part of the skin to exceedingly low intensity sources of vital ultraviolet equal short exposure to high intensity sources of the same zone of ultraviolet, depends the future of hygienic use of ultraviolet emanators.

18 East 89th Street.

Ueber Die Trachombehandlung Durch Radiumemanation (Radon). [Treatment of trachoma by radon (radium emanation).] J. W. Selenkowsky and A. A. Malischeff.

Klin. Monatsbl. f. Augenhlkde, 82:162, 1929.

The most important properties of radon, a gaseous radioactive element, consist in its emanation of the same alpha, beta and gamma rays as radium. The favorable action depends on the gamma rays. Radon is administered in small glass capillaries with definite emanation effects. A mask of Pasta Colombi, a pliable mass composed of wax, paraffin and saw dust, is moulded on the patient so as to cover his eyes and partly the bridge of his nose. On this mask is put a lead plate 1 to 2 mm. thick, to which in turn the glass capillaries containing radon are fastened. The lead plate serves as filter and transmits only the efficient gamma rays. The capillaries are furthermore covered by a second lead plate which impedes the emission into the surrounding space. The dose was 0.3 to 0.6 millicuries, the duration of the treatment 3 to 4 days, during which time the eyes are examined daily by taking off the mask. Radon therapy proved most efficient in purely granular trachoma, and also in severest cases. In other stages of trachoma, too, radon produces complete disappearance of the follicles. In case of *pannus tenuis* only improvement is to be obtained, while *pannus crassus* baffles any therapeutic method. The effect of radon is entirely identical with that of radium, the duration of treatment is, however, considerably shorter.

CURRENT NEWS AND COMMENT

Stabilized Death Rate From Cancer Predicted

Optimism and determination were the guiding spirits which pervaded the cancer symposium held in Washington under the auspices of the National Institute of Health.

Not even the statement by Dr. J. W. Schereschewsky of the U. S. Public Health Service, that cancer has undeniably increased, dampened the hopeful, fighting spirit of these men.

"The conclusion was reached that in the 21-year period from 1900 to 1920, about two-thirds of the increase observed in the cancer death-rate of persons 40 years and over was due to an actual increase in the mortality from the disease," he said.

"We may venture to hope that the cancer death-rate will not continue to grow indefinitely," he continued. All physical, chemical and biological processes tend to a state of equilibrium. Even without the discovery of preventive measures, the cancer death-rate will sooner or later become stabilized, he ventured to predict.—*Science News Letter* (January 17), 1931.

Schellberg Patents Have Been Again Declared Valid and Infringed

On the twenty-eighth day of March, nineteen hundred and thirty-one, in the District Courts of the United States for the Southern District of New York at the Borough of Manhattan, City and State of New York, a permanent injunction was obtained by the Schellberg Manufacturing Corporation against Dr. Edmond M. DeBerri.

"The defendant was strictly commanded and enjoined, his servants, agents, employees, licensees, assignees, and all others acting in association with him or under his direction, control, permission or authority for the remainder of the term of the life of said Reissue Letters Patent from further infringing the same and from making, vending, advertising, offering for sale, or giving away, or using or in anywise directly or indirectly causing, contributing to or being concerned in the making, vending, advertising, offering for sale or giving away or using machinery, device or apparatus for proctotherapy or any apparatus for colonic treatment made in accordance with or containing or embodying the inventions described and claimed in the U. S. Letters Patent Reissue Number 16251."

The foregoing decision is not alone valid against Dr. DeBerri but the users of these infringing apparatuses.

DeBerri Apparatus

Features Infringed—Plurality of percolators terminating in a common fitting; a three-way valve; a colon tube; an operating table with sewer drainage.

Claims Infringed—In a medical apparatus as characterized and in combination with a supply of medicament, a flexible delivery tube having a length adapted to extend through the intestines from the rectum to the lower end of the ascending colon, means at the delivery end of said tube adapted to permit the passage thereof through the intervening sphincters, said means embodying a closure at the tube end and relatively staggered apertures formed in the sides thereof, a manually operable two-way valve between said supply and tube and having a drain disposed for siphonic action in said tube.

The manufacturers are careful to conceal from the purchasers, that those that use such apparatuses are liable under the law.

Washington Tuberculosis Association

Announcement of the annual meeting of Washington Tuberculosis Association to be held in Wenatchee June 11-13 has been made from the headquarters of the Association in Seattle. Peculiar interest is attached to the meeting this year as it celebrates the twenty-fifth anniversary of the organization which was formed in 1906, and those in charge of the program plan to show the progress made in the fight against tuberculosis during this period.

An effort is being made to have present as many as possible of those who took part in forming the organization and who served on the first board of directors. Less than half of this number are now living, some of whom are still actively engaged in the procedures of the Association. Everyone who is interested in tuberculosis work is earnestly invited to attend the meeting and take part in its deliberations.

Tubercle Bacillus Killed By Part of Itself

New progress in the inquiry into the chemical nature of the bacilli of tuberculosis, was reported to the American Association for the Advancement of Science in Cleveland, by Prof. R. J. Anderson, of Yale University, one of the scientists co-operating in a joint offensive on the tubercle bacillus by the National Tuberculosis Association. Millions of germs have been analyzed and in the fatty portions have been found many unusual compounds, including a sugar that kills those infected and is harmless to those who are well.

Now experiments by some of Dr. Anderson's fellow workers indicate that one portion of the fat from the germ actually is antagonistic to the germ itself and acts as a true antigen. This may prove to be of practical use eventually in the control of tuberculosis.

An acid new to chemistry that is the cause of the formation of the tubercular tissues has been isolated from the fat of the tubercle bacillus by Dr. Anderson and named phtioic acid. Thus a chemical causing the symptoms of tuberculosis has been found.—*Science News Letter* (January 17), 1931.

Complete physiotherapy equipment has been installed in the Missouri Baptist Hospital, St. Louis, the gift of Dr. Andrew B. Nichols, retired St. Louis physician. More than $5,000 worth of new apparatus has been installed in the department which occupies a third of the space on the fourth floor of the new wing of the building. Thus equipped, the physiotherapy facilities of the hospital are surpassed in St. Louis only by the Government hospitals.

Third International Congress of Radiology

(*Continued from page 296*)

also have facility to visit the Colonial Exhibition.

Lodging—Visitors will benefit by a reduction of 50% on the fare to and from the Congress, on the French railroads.

After the Congress and from 2nd of August, 7 different travelling parties will be organized by the Tourist Office of the Congress in the principal touristic, thermal and climatic regions of France.

1. Lac du Bourget — Lac d'Annecy — Chamonix—Mont Blanc—Evian (from 2nd to 9th of August), 1,650 francs.
2. Aix les Bains—Lac du Bourget—Route des Alpes with autocar—Nice—Monte Carlo—Côte d'Azur (from 2nd to 10th of August), 1,500 francs.
3. Carcassonne—Route des Pyrénées with autocar — Font — Romeu — Luchon — Biarritz—Côte d'Argent (from 2nd to 10th of August), 1,800 francs.
4. Normandie—Mont St. Michel—Côte de Bretagne with autocar—Vannes (from 2nd to 9th of August), 1,490 francs.
5. Vittel—Lakes and Passes of the Vosges —Alsace—Strasbourg (from 2nd to 7th of August), 1,040 francs.
6. Vichy — Auvergne — Puy de Dôme (from 2nd to 6th of August), 685 francs.
7. Castles of the Loire—Blois (from 3rd to 6th of August), 555 francs.

During these tours, visitors will be received in the principal thermal and mineral watering places and visit them.

The Tourist Office of the Congress can also organize, accordingly to the wishes of Congressists, any tour or stay in Franc after the Congress, separately or in parties. Demands to this effect to be addressed to the Office of the Congress.

Congress Enrollment—We beg to remind that Titulary Membership of the Congress is opened only to Members of Radiological Societies and to persons accepted by these Societies (Titulary - Membership's fee: 300 francs).

Adjunct membership is limited only to the wives and children of Congressists (Adjunct Membership's fee: 50 francs).

Physicists Now Sure Vibrations Occur in Heart of Atom

Vibrations within the innermost core of the atom have been proved to exist by firing high speed alpha rays into aluminum atoms, scientists of the Physical Institute of the University of Halle report.

The capture of a helium bullet by the excessively small heart or nucleus of an aluminum atom has been used in this work by Dr. H. Pose and Prof. G. Hoffman to probe the last great secret of the structure of matter. For this collision of the alpha particle with the aluminum atom is the signal for the ejection from the aluminum nucleus of a still faster kind of rays, the proton rays.

Those protons have been successfully cross-questioned by Dr. Pose and made to tell the story of the aluminum nuclei they have so suddenly left. Actually they are the cores of hydrogen atoms in rapid motion.

Four to five million volts would be required to give the hydrogen cores their high speeds by artificial means.

The speeds of those protons and of the particular alpha ray projectiles which start them on their way, give the new evidence of vibrations in the target atoms of the aluminum. At least Dr. Pose calls them vibrations.

Nothing material vibrates, however. Only a mathematical function with a highly complicated formula and the Greek name Psi. Physicists have been wary of making concrete pictures of the inside of the atom recently since the arrival of the new quantum theory.

The Psi vibrations are found in tune with oscillations which accompany certain of the alpha rays on their journey, called the De Broglie waves, another of the conceptions of the new physics. A proton is ejected when these two kinds of oscillations get into step, just as an organist by playing the right note may wreck a building.

Distances traveled by the hydrogen particles before coming to rest in the air are used to measure their starting speeds. Dr. Pose found that three groups of hydrogens of differing speeds were sent out by the aluminum atoms.

The two faster groups which pass through 20 and 24 inches of air before stopping, appear only when special speeds of alpha-helium rays are present in the projectile atoms. The speed of the alpha rays determines the frequency of the accompanying De Broglie waves.

Dr. R. W. Gurney, working at the Institute of Physical and Chemical Research, Tokio, Japan, had previously suggested that resonance phenomena might be found in the nucleus similar to that observed in the outer layers of the atom. Dr. Pose believes that his own experiments show this. Slower projectiles with a voltage equivalent of 10 to 20 volts, for instance, cause the emission of colored light from the target atom when their speeds reach a very definite value.

Recent experiments of Drs. J. C. Chadwick, J. E. R. Constable and E. C. Pollard at the University of Cambridge, England, however, show that "alpha particles which are not in resonance with the nucleus are nevertheless able to cause a detectable amount of disintegration."

The alpha rays used by the German investigators are helium atom kernels given out by polonium, a radioactive substance similar to radium.—*Science News Letter,* March 28, 1931.

Roentgenologic Demonstration of Liver and Spleen

Addressing the Berliner Medizinische Gesellschaft recently, Dr. Radt, on the staff of the Moabit Hospital, discussed "Roentgenologic Demonstration of Liver and Spleen with the Aid of a New Contrast Medium." By the intravenous injection of a thorium dioxide solution, which is deposited in the reticuloendothelial apparatus, Radt succeeded in bringing out clearly in the roentgenogram both the liver and the spleen as organs presenting uniform shadows. The diagnosis of cancer metastases, which appear as figures of lessened density, can be confirmed in this manner. Experimental animals and human beings suffer no evil effects from the use of this contrast medium. The roentgenograms presented were excellent and were highly approved by the Assembly.—Foreign Letters, *Jour. A. M. A.,* 95:1761 (Dec. 6) 1930.

Electric current direct from sunlight was made possible through the invention by Dr. B. Lange, of the Kaiser Wilhelm Institute for Silicate Investigation, of a new type of cell containing copper oxide between two layers of metallic copper.—(*Science News Letter,* Dec. 27, 1930.)

Camera for Patients to Swallow

Successful experiments have been made at St. Mary's Hospital, Paddington, with a camera, invented by two young Austrian scientists, by means of which the interior of the stomach of a patient who has swallowed it can be photographed.

The working of the camera was described by a specialist in stomach ailments, who stated that he found the instrument very easy to swallow and suffered no ill effects. He explained that the camera not only photographs the entire wall of the stomach on sixteen plates, each the size of a snip out of a tramcar ticket, but it operates with a flash of 200,000 candle-power and does its work in 20 seconds. He added:

"The camera, which costs £160, is in the form of a small cylinder about 2 in. long and 5/8 in. thick. Two parts are of metal, and the intermediate portion of unbreakable glass. This part contains the lamp. The camera is at the end of a semi-flexible tube which contains two wires—one for carrying the current for the flash and the other for operating the tiny shutters. The flash is really a fuse. First, electric current is brought from a plug to a transformer, and then to a fuse. As it breaks this fuse there is a second fusion in the camera. It is absolutely safe, the first fuse protecting the patient wholly. It is quite cold. The plates are 12 by 10 millimetres each, and are all assembled, and the photograph enlarged 100 times. The photographs require expert investigation. I consider the invention a tremendous technical achievement. It will mean a new line of investigation, and has minimized the difficulties of the detection of cancer of the stomach."—(*The Times*, Feb. 7, 1931.) From the *Brit. Jour. Rad.*, 4:99 (March) 1931.

Molecules Rebound Safely From White-Hot Surface

Chemical molecules can be handled very roughly without breaking them into fragments, experiments by Prof. F. O. Rice and Dr. Harold T. Byck at the Johns Hopkins University, Baltimore, Md., demonstrate.

Prof. Rice's work gives one answer to a problem that has occupied the attention of physical chemists for twenty years: how is heat transferred from the walls of a container to the gas inside—which is continuously in motion?

Acetone molecules which ordinarily decompose at a temperature of 1000 degrees Fahrenheit into the gas methane and other products, were bounced from a white hot platinum surface at 2900 degrees Fahrenheit without change, in Prof. Rice's experiments. Previously it had been assumed that a certain fraction of the molecules sit down on the surface for a while, then get up and leave. When things get this hot it seems they cannot be persuaded to stay on the hot surface.

Many chemical substances decompose when heated, as the amateur housewife knows from her cooking. Prof. Rice has been attempting to decide whether this decomposition is due to the heat rays from the walls of the vessel enclosing the substance or to the fact that at higher temperatures the gas molecules collide more violently with each other.—*Science News Letter* (February 21) 1931.

The problem of the proper care of chronic invalids and of patients convalescing slowly from severe illnesses has occupied the attention of hospital executives during the last several years. The solution is not easily arrived at because of the numerous angles which it presents. Chief among these of course is the high cost of hospitalization and the low income of many people which make it practically impossible for many chronic and convalescents to enter modern hospitals, or, when admitted, compelling the institutions to bear a large portion of the expense incident to their care. Modern first-class general hospitals do not provide the special equipment and personnel needed to give these unfortunates continuous residence, treatment and care over long periods and the establishment of a special wing or even a floor for their use would be expensive and probably not self-supporting. These people must, therefore, go into so-called "homes" or be cared for by relatives in their own residences.

A recent attempt to solve this problem is meeting with encouraging success. We refer to the Palmer Sanatorium and Convalescent Hospital at Springfield, Illinois. With very little addition to its equipment and personnel this institution has established a section devoted wholly to the care of chronic cases and slowly convalescing patients. The splendid record attained by it in the treatment of tuberculosis since 1913 is a good augury for this class of patient.

QUESTIONS AND ANSWERS

Q. Is there a standardized dosage of ultraviolet in a disease like rickets? What is the present plan of resorting to small doses of radiation with the quartz lamp?

A. There is as yet no standardized dosage of ultraviolet therapy for rickets or any other disease in which such treatment is indicated. Each worker prefers some special plan of dosage and believes that with it he is able to obtain the best results. The tendency at first was to give small doses and build up gradually to a certain maximum. Some preferred to produce an erythema at the first treatmeint. Others claim an erythema is unnecessary for systemic reaction. Volmer (*Klinische Wochenschrift,* 9:2300 (Dec. 6), 1930, is of the opinion that the final result is the same whether small or large doses are applied. Too large quantities applied not only overburden the child but also are a waste of time and electricity. Results in a study of forty-three nurslings are cited. Volmer believes that a weekly irradiation of from four to five minutes on the chest and back is the minimal effective dose. The dose for prophylaxis and the dose for therapy is practically the same. The author stresses that the results obtained with minimal doses are more favorable than those obtained with other treatments of rickets.

Q. Is there a method of purifying radium emanation?

A. Several methods of purifying radium emanation are now known. Two simple procedures are described by Moran (*Am. J. Roentgenol.* (Aug.) 1929; *B. J. Radiol.* (Dec.) 1930. A summary of this author's article follows:

"A simple apparatus for the purification of radium emanation is described, which is low in cost and easy of operation. The use of liquid air is avoided and the removal of water vapor has been found unnecessary. Two different methods of purification are given. One method ignites the oxygen and hydrogen with a hot copper oxide filament which also oxidizes the excess hydrogen. The other method uses a spark to unite the oxygen and hydrogen, while the excess hydrogen passes through the walls of a heated palladium tube into the outside air. The emanation is pumped from the solution into the single small purifying tube and from there pushed directly up into the thin-walled capillary. The emanation may be withdrawn and collected over mercury at any stage in the purification. The concentration attained compares favorably with the results obtained with complicated installations."

Q. What is the status of high voltage Roentgen therapy of cancer of the mammary gland?

A. There is such a variety of opinions on this particular form of treatment for carcinoma that it is extremely difficult to know what to say. There have been good, bad and indifferent results with deep roentgen ray therapy of malignant new growths. Those who have had some success are naturally enthusiastic and continue to advocate this method. A recent paper dealing with five-year results of deep roentgen ray treatment of mammary carcinoma is contained in the (Dec.), 1930, issue of the *Am. J. Roentgenol. and Rad. Therapy.* (24:673.) The authors, Evans and Leucutia, believe that in its short wave length application, roentgen therapy is an aid in treatment of operable mammary carcimona as an auxiliary to surgery.

"Whereas, in the cases without glandular involvement, the addition of irradiation does not seem noticeably to increase the five-year results above those of surgery alone, assuming, of course, that all the diseased tissues were removed, in the carcinomas that had already spread to the axillary or the high thoracic lymph nodes the five-year results are nearly doubled. The best method of procedure is a combination of radical surgery with a thorough systematic irradiation of the entire anterior thorax, axilla and neck on the diseased side. In the inoperable or recurrent mammary carcinomas, roentgen therapy produces prolongation of life if the lesion is localized to the adjacent lymph nodes or anterior thorax and alleviates the symptoms."

THE STUDENT'S LIBRARY

CANCER: ITS ORIGIN, ITS DEVELOPMENT AND ITS SELF-PERPETUATION: THE THERAPY OF OPERABLE AND INOPERABLE CANCER IN THE LIGHT OF A SYSTEMIC CONCEPTION OF MALIGNANCY. A RESEARCH. *By Willy Meyer,* M.D., Consulting Surgeon to The Lenox Hill and Postgraduate Hospitals, New York Infirmary for Women and Children, etc.; Emeritus Professor Surgery, N. Y. Postgraduate Medical School. Cloth. Pp. 427, with 11 portraits and 5 illustrations. New York: Paul Hoeber, Inc., 1931. Price $7.50.

Probably no other problem in modern medicine has engaged the attention of the scientists and the medical profession as has the ubiquitous problem of cancer. In spite of the tremendous literature that has sprung up, no radical discovery suggestive of a new advance has come out of it. The entire subject is still surrounded by speculation and theory; nothing of real concrete value is known of its genesis. Such is the situation out of which the author has attempted to correlate the essential facts and theories of the subject. The present volume is a summation of the current concepts in the cancer problem. The book has attempted to review the various theories, including those advanced by the author in previous years, in order to direct attention to the various therapeutic methods that have been developed in the defense against its progress. Under separate headings it, therefore, discusses the various aspects of the problem. The theory is advanced that cancer is a "product of two jointly effective chronic irritations:—systemic and local." Within this thesis is incorporated the general and local inciting factors such as the parasitic theory and the changes and characteristics of the single cell undergoing deviation toward the malignant state. The author touches upon every legitimate characteristic of the cancer situation—the predisposition and hereditary state, the influence of age and the problem of metastasis.

The second and last part of the book discusses the therapeutic aspects of the problem in a most intriguing manner. Herein the author suggests the need for a new departure in our therapeutic methods by reviewing some of the remedial measures outside of radiation. A great deal of exposition has been devoted, for example, to the influence of fever in cancer to the influence of Coley's fluid. That there is a perversion of body chemistry is demonstrated by the marked alkalosis in connection with cancer and the acidosis following the action of Coley's fluid. It is apparent from the space and the stress laid upon the foregoing pages that the author is convinced that "The" future therapy of cancer will be found when science will discover a safe method of producing a state of acidosis in the inoperable cancer patient.

In spite of the intriguing character of the views presented herein, one should not forget that nothing more concrete than theory has gone into the structure of the author's thesis. That the arguments carry conviction and the style and the material have the indices of scholarly labor is a greater proof for the power of the author's pen than for the actual facts in the case. However, until a work is published that has for its background information of a more substantial nature, this book should be regarded as one of the authoritative contributions on the subject.

UTERINE TUMORS. By *Charles C. Norris.* Professor of Gynecology and Obstetrics and Director of the Department, University of Pennsylvania, etc. Pp. 251. Price $3.00, New York. Harper & Brothers Publishers, 1930.

This book, as one of a series of Harpers' Medical monographs, is recommended to the practitioner and specialist for its thoroughness and concise presentation. Its lack of redundency should make this book popular with the busy doctor. Carcinoma of the cervix, the most important of tumors of the female genital tract is as thoroughly presented as one might expect from the experience that the author has had. More and more one notes that the gynecologists are preferring irradiation therapy to the radical hysterectomy in the early cases. The high primary mortality, together with the prolonged stormy convalesence as found in the radical Werthheim operation, when compared to the ease and safety of irradiation definitely make one favor the latter since the statistics of five year cures are as good if not better. The author prefers the sharp knife in obtaining biopsy material. This is contrary to some modern viewpoints where the high frequency electrotome offers a bloodless method safe from lymphatic dissemination.

All of the material presented throughout this book is well rounded out with elaborate consultation of the literature and tabulations of the results of others as well as the author's. This book, bound in pocket edition size is once more recommended to all physicians.

TEXT-BOOK OF MEDICINE. Edited by *Russell L. Cecil,* A.B., M.D., Sc.D., Assistant Professor of Clinical Medicine in Cornell University; Assistant Visiting Physician in Bellevue Hospital, New York City. And Associate Editor for Diseases of the Nervous System, *Foster Kennedy,* M.D., F.R.S.E., Professor of Neurology in Cornell University; Head of Neurological Department, Bellevue Hospital. Second Edition, Revised and Entirely Reset. 1592 Pp. Philadelphia and London: W. B. Saunders Company. 1930. Cloth, $9.00.

There have been numerous text-books on medicine which have come from the press in recent

years. Some of them represent the individual viewpoint of one author and are therefore narrow in this regard. This book is the product of numerous teachers and clinicians and thus gives a diversity of viewpoints on the multiplicity of diseases encountered in practice.

It is at once evident after a careful analysis of the text material that the writings are authoritative. The authors have been selected because of their special ability to give in a comprehensive style the newest knowledge of the various diseases. The references at the conclusion of each author's contribution are helpful to the reader and enable him if he so desires to investigate the subject further.

The first edition of this text was presented to the medical profession four years ago. As numerous changes have resulted in the original contributions a resetting of the whole book was found necessary by the publishers. A new chapter on Tularemia has been contributed by Dr. Edward B. Francis. Recent advances in this disease have been recorded in the medical literature and such facts are to be found in this new chapter. Other new contributions are also to be found, in particular, one on Agranulocytic Angina. While much remains to be investigated in this disease, Dr. L. W. Gorham presents a treatise that brings our knowledge of it down to date.

As is stated in the preface by the editor: "It is doubtful whether any author of the future will have the temerity to write a complete text-book of medicine without considerable collaboration." The age of specialism is upon us and it is not unusual for a physician to devote his entire time and efforts towards the solution of a single disease. It is only natural, then, that the highly authoritative contributions should come from the pen of individuals who are in this day known as specialists.

A work such as this is indispensable for reference. The specialist and the general practitioner can learn much from its contents. To the reviewer it represents a valuable addition to modern medical texts full of rich, lucrative information, "the last word on the subject."

ROSE AND CARLESS' MANUAL OF SURGERY FOR STUDENTS AND PRACTITIONERS. By *Cecil P. G. Wakeley,* F.R.C.S., Eng. F.R.S., Edin. and John B. Hunter, M.C., M.Chir. Cantab., F.R.C.S. Eng. Thirteenth edition. 1592 Pp. New York. William Wood & Company. 1930. Cloth, $11.00 net.

Twelve editions of this monumental work have appeared before this. This one, the thirteenth was necessitated by the changes which have taken place in modern surgery. It will always serve as a textbook for students preparing for examinations and also as an authoritative reference volume for practitioners when face-to-face with surgical problems.

Three years only have elapsed since the last edition of this comprehensive work was published. The fact that a new edition now has made its appearance is a testimonial to the regard with which students and practitioners alike hold for such an exhaustive contribution to modern surgical text books.

Carless' influence is still felt in the present volume. Although not actively engaged in this production, his helpful suggestions are gratefully acknowledged by the editors, who say in part: ". . . his stimulating enthusiasm, his wealth of surgical knowledge, and his ever-ready help were invaluable in the preparation of former editions . . ."

"The name of Carless will be remembered for many years to come, as his textbook, which first appeared in 1898, has already gone through twelve editions, and has been translated into many languages, including Chinese and Arabic."

Many new illustrations have been added. They are not only numerous but of the best quality. The radiographic supplement is indeed a helpful section for the student who is preparing himself for actual surgical practice and needs to know how to interpret the radiogram and apply the knowledge from it to the case at hand. Mention is made by the editor of the chapters which have been revised. These are listed in the table of contents. Chapters concerned with the surgery of the ear, nose and throat have been brought up to date, while a chapter on the Surgical Affections of the eye represents new material. Other new chapters have been added and wherever revision has been thought necessary new material has been injected.

The publishers should be congratulated on the high standard of this book. It will remain the masterpiece of surgical texts. While new volumes may appear from time to time, to the student, Rose and Carless' Manual of Surgery will always hold first place for reference and study. To the practitioner, it will continue, as in the past, to solve the difficulties which always are present in a surgical practice.

This book needs no recommendation from a reviewer. It recommends itself. The price is well spent for even a mere casual perusal of its contents.

CANCER OF THE LARYNX. By *Sir St. Clair Thomson,* M.D., F.R.C.S., F.R.C.P., Emeritus Professor of Laryngology in Kings' College Hospital and Lionel College, M.B., F.R.C.S., Surgeon to the Throat Department, St. George's Hospital. 244 Pp. Cloth. Price, $7.00 net. New York. The Macmillan Company. 1930.

This is one of the books included in the Anglo-French library of medical and biological science edited by F. G. Crookshank, M. D., (London) and Prof. René Cruchet, (Bordeaux).

The author, Sir St. Clair Thomson is well known for his contributions to the subject of cancer—and, in particular, cancer of the larynx. At first glance it appears dubious that one could compile a sufficient amount of worth-while material to write a book on this subject. A further analysis, however, not only dispels this view, but at once emphasizes the fact that a systematic consideration of this problem is timely, instructive and most helpful to every physician be he specialist or general practitioner.

Of course, the specialist in laryngology is most appreciative. It is he who must contend with the frequent difficulties of diagnosis, of prognosis, and of treatment. While it is true that the incidence

of cancer of the larynx is comparatively rare, (1.8 in every hundred deaths due to cancer), the unusual responsibility which is thrust on the laryngologist in the individual case is ample reason for an intensive desire of familiarity with the problem in general. Thomson believed, "the moment appears propitious for writing a sequel to Butlin's essay of forty-six years ago. It is based partly on opportunities for seeing and appreciating what has been done elsewhere, but chiefly on personal work and experience." The 106 illustrations and their legends are most helpful to the reader.

There is little in the way of argument concerning the importance of frequency, etiology and classification of cancer of the larynx. Yet these are academic considerations, less important than pathology diagnosis and therapy. Thomson's review of the pathology of cancer of the larynx is most comprehensive, that of a diagnosis and prognosis individual. For instance, his expression: "Untreated malignant disease of the larynx inevitably ends in death by asphyxia, dysphagia, hemorrhage, sepsis, cachexia or intercurrent complication," tells in a brief manner what many authors require pages for elucidation.

The chief message of the book is the treatment and this is introduced by a consideration of the principles. The modern concept of correct management of a cancer of the larynx involves its radical removal. The one point of argument which has occasioned more writing than is worth while is that of approach of the growth. In this monograph the various operative procedures are described and discussed. The laryngofissure route has its adherents and will continue to have them. The more radical lean to laryngectomy because they look upon laryngofissure as a failure. Those who are desirous of learning technic, after treatment and general care of these cases are referred to the valuable information which these chapters contain.

Treatment by radiation occupies Chapter XIII. Radium and X-Rays are considered. It is quite evident that Thomson thinks unfavorably of these agents, at least, he has observed from them less successful results than from laryngectomy. As in the case of operative procedures, radiation therapy has its staunch adherents. Thomson quotes Gabriel Tucker, who, he believes, represents the general opinion in the United States when he writes: "The use of radium and X-ray is now generally conceded to have no place in the treatment of cancer of the larynx, except in some cases as post-operative radiation after laryngofissure or laryngectomy to prevent glandular invasion."

The reviewer has been fortunate in the opportunity to peruse this excellent work. It represents the "ultimate" on laryngeal cancer. While modifications of technic in operative procedure will undoubtedly be suggested from time to time, until a specific cure for cancer is advanced, laryngectomy as advocated by Thomson will continue to be the ideal means of management. It is difficult to understand how the modern laryngologist can afford to be without this new book. It is strongly recommended.

CHRONIC NASAL SINUSITIS AND ITS RELATION TO GENERAL MEDICINE. Based on the Author's Semon Lecture, University of London. The Toll of Nasal Focal Sepsis on Body and Mind. By *Patrick Watson-Williams,* Hon. Consulting Surgeon in Diseases of the Ear, Nose and Throat, Bristol Royal Infirmary; late Lecturer on Oto-Rhino-Laryngology in the University of Bristol; Hon. Member of the Laryngological Society of Vienna; Corresponding Member, Oto-Rhino-Laryngological Society of France, etc. 221 Pp. Cloth. Price, $5.00 net. New York: William Wood & Company. 1930.

This volume is mainly concerned with a brief account of the pathogenesis of the systemic toxemias and secondary infections of chronic nasal sinusitis. The author believes that because the systemic effects of nasal sinus infections are barely mentioned in most special text-books, a treatise such as this has a definite place in medical literature.

Part I deals with pathology, symptoms and systemic effects; part II, with diagnostic methods and treatment. Ten chapters are included in the first part and five in the second. 109 illustrations are interspersed in the text material.

An interesting discussion in the introduction is on the futility of indiscriminate operations. The fact that an opinion is expressed on this subject is refreshing as it at once portrays an attitude of conservatism on the part of the author. Emphasis is also made on the need for greater precision in diagnostic methods and "diagnostic exploral suction" is detailed.

As one would expect much of the material is devoted to the relationship of sinusitis to general medicine. In this connection, one of the important considerations, that of the respiratory tract and gastro-intestinal tract is reviewed in Chapter VIII. Cardiac, arthritic and skin infections are covered in Chapter IX, while orbito-ocular affections are included in Chapter X.

The chapter on treatment is just a bit too brief. Important procedures are described, but not in the detail necessary in a book embracing such an important subject as chronic sinusitis. Only very brief mention is made in this chapter on the work which has been done with vitamins. It seems that a more comprehensive review of the literature dealing with this problem would aid in emphasizing the significance of vitamin therapy.

The reviewer appreciates the fact that the book is intended to cover only one aspect of the problem of nasal accessory sinus disease—that of its relation to general medicine. As such, it has fulfilled its mission well. There is sufficient original text material to lend a new perspective to the rhinologist. The author possessed this new perspective and it should not be difficult for the rhinologist to acquire it after a careful perusal of this contribution. Of the books written on sinus disease during the past two decades, this is valuable addition for study and reference.

INTERNATIONAL ABSTRACTS

Die Ionophorese Bei Komplikationen Der Mannlichen Gonorrhoe. (Ionization for complications of male gonorrhea). J. S. Beirach, R. J. L. Langermann, and J. W. Chorosch.

Dermatol. Ztschr. **59:***208, (Sept.) 1930.*

The procedure of introducing ions of various elements into the system by means of the galvanic current is well known and has been frequently used. Among the remedies most often used for residual inflammatory infiltrations and adhesive processes, iodine ions occupy a popular position. The electrodes must of necessity be adapted to the part treated. Small zinc plates, 0.5 mm. thick were employed in all cases except for prostatitis. A zinc plate measuring from 150 to 200 square cm., was fixed on the *mons veneris* to serve as an indifferent electrode. The active electrodes varied in size and shape and rested on several thicknesses of hydrophilous gauze moistened with 1 percent potassium iodide solution, placed over the diseased organs. As the iodine ion carries a negative charge the active electrode was connected with the cathode, the indifferent electrode with the anode. Strictures were treated by means of square electrodes about 30 square cm. in size and placed along the course of the urethra corresponding to the location of the scar. The amperage varied between 30 and 40 M.A., the treatment time being from 15 to 30 minutes. In cavernitis an oblong-square active electrode, of 15 square cm., in size was used, with an amperage of 10 to 40 M.A., the time of treatment 15 to 30 minutes. In case of epididmitis an oval electrode with a surface area of 50 square cm., was placed on the bottom of a large, flat, porcelain cup, the scrotum being placed on hydrophilous tissue moistened with potassium iodide, and placed between the electrode and the skin. The current employed was from 20 to 30 or 50 M.A., and the time of treatment 15 to 30 or 45 minutes. As a rule the treatments were given three times a week.

In prostatitis and spermatocystitis the active electrode was formed by a straight, hard rubber bar, the free extremity of which terminated in an olive-shaped carbon point, 2.5 cm., long and 1 cm., in diameter, while the other extremity was fitted with a handle perforated by an opening which received the conductor of the galvanic current apparatus. The carbon electrode was wrapped in a cotton and Marly plug, moistened with 1 percent potassium iodide solution and tightly laced around. To facilitate easy removal of the plug from the rectum, a long strip of Marly gauze attached to the plug is left without. The indifferent electrode, 150 square cm., in size is then placed on the *mons veneris,* the amperage being from 20 to 60 M.A., and the treatment time from 15 to 30 minutes.

Generally speaking, the authors obtained favorable results by ionization in complications of chronic gonorrhea in the male. In prostatitis the effect can also be beneficial. Acute conditions are a contra-indication to ionization. In refractory complications in old people the results are greatly enhanced when it is combined with other physical therapeutic methods, such as diathermy and mud treatment. Focal reaction is very desirous in cases where ionization is indicated, and constitutes a good indicator of the successful progress of this mode of treatment. In suitable cases ionization can be recommended.

Die Roentgentherapie Des Erysipels. (Roentgentherapy of erysipelas). Karl Fried.

Strahlenther. 1929, 33:673 (September) 1929.

The author generally obtained very gratifying results by roentgen ray treatment of erysipelas and erysipeloids in the Roentgen Institute of the Hebrew Infirmary at Breslau. The excellent and good results amounted to 80.5 per cent. Out of the 42 cases of erysipelas 22 cases had cleared up in from 24 to 48 hours, or had become apyretic with the stoppage of progress of the redness; 12 further cases showed improvement by only one irradiation after from 3 to 4 days. In contradistinction to other radiologists Fried worked with small amounts of roentgen rays. His doses vary from 120 to 200 r per field. When only one field is necessary, from 160 to 200 r are given; when, however, several fields have to be treated on account of the expansion, so as to encroach on one another at the borders, as in irradiation of the cheek and scalp of the same side or when the one field forms an additional dose to the opposite one, as in the irradiation of both cheeks or of one thigh from the extensor and flexor aspects, the author administers only 120 r per field, Voltage 100 to 160 K.V., 4-8 M.A., filtration by 0.5 mm Zn or 0.5 mm Cu plus 1 mm Al. The size and correct distribution of the fields are often decisive for irradiation effect. On principle an apparently "healthy" area has to be involved freely in irradiation beyond the visibly affected zone to all sides three finger or hand's breadth, for there the morbific agents are already lodged in the lymph spaces and large erysipelas areas must be divided into several fields. But when an erysipelas is so extensive, that the patient cannot be expected to undergo irradiation of the necessary number of fields, the centre of the erysipelas may be excluded from irradiation and only those borders irradiated, where it is progressing. In most cases a simple irradiation will do. In migrating erysipelas from 2 to 3 repetitions are necessary, but every two irradiations should be spaced by at least 24 hours.

Skin Cancer: Production by Prolonged Ultraviolet Irradiation. W. Putschar and F. Holtz.

Zeitschrift fur Krebsforschung, Berlin, 33:219, (December 22), 1930.

Putschar and Holtz chose rats instead of mice for their experiments because of the fact that whereas the spontaneous development of cancer is relatively

frequent in white mice it is extremely rare in rats. A strain of rats was used in 10,000 of which over a period of three years not a single spontaneous skin tumor was observed. It was found that cancer of the ear could be produced with great regularity without the aid of chemical agents by prolonged ultraviolet irradiation. The carcinomas appeared at the earliest after twenty-seven weeks of continuous irradiation. By the end of the thirty-seventh week, all the six animals had cancer. A definite relation between the color of the skin and the susceptibility to cancer was not demonstrated. The administration of viosterol changed neither the susceptibility to tumors nor their rate of growth. Changes in the elastic tissue in the skin were of a purely retrogressive nature; they did not show any relation to the development of cancer but were a manifestation of chronic ultraviolet ray dermatitis. The specific action of the ultraviolet rays consisted in the production of a periodic regeneration of the hair with a marked increase in the number of lanugo hairs and the development of giant hairs. The authors believe that there exist close histologic relations between ultraviolet ray cancer and the precancerous light dermatoses that occur in man. The experiments prove the etiologic rôle of ultraviolet rays in cancer of the skin in human beings.—Ab. *J. A. M. A.* Vol. 96:989 (March 21,) 1931.

The Radium Treatment of Cancer of the Bladder. B. S. Barringer.

Jour. A. M. A., 95:1734 (December 5), 1930.

1. Tumors of the bladder should be classified according to their relative malignancy (Broders' method). In this way a comparison of results can be made.

2. The papilloma with atypical cells should be regarded as a malignant tumor and so treated.

3. If only the projecting part of a tumor is removed for pathologic examination, the clinical estimate of a tumor's malignancy should receive more weight than the pathologic.

4. In 127 cases, the results of radium implantation were: Of forty-five cases of papillary carcinoma, twenty-five cases, or 55.5 per cent, were controlled more than three years. Of eighty-two cases of infiltrating carcinoma, twenty-three cases, or 27.5 per cent, were controlled more than three years.

5. The suprapubic implantation by radium has an operative mortality of between 3 and 4 per cent, while the operative removal has a mortality of between 10 and 20 per cent.

When one considers that all tumors of the bladder excepting those which had extended beyond the bladder were irradiated and included in these statistics, one gets a fairly comprehensive idea of the decided superiority of radium removal to operative removal.—(Author's own conclusions.)

Die Kohlenoxydvergiftung und Deren Neuartige Therapie Mit Bestrahlung. (Carbon monoxide poisoning and its novel therapy by irradiation). F. Koza.

Med. Klin. 26:418 (April) 1930.

Ultraviolet rays for the treatment of carbon monoxide poisoning produce good results if routinely accompanied by a copious use of ozone. The author verified his results not only on clinical material but also by animal experimentation. A clinical case is described where artificial sun was administered to the whole of the body front and back at a distance of 60 cm. for 20 minutes each. This was followed by rubbing the skin until dry in order to provoke hyperemia of the cutaneous vessels. After the irradiation, that is after 40 minutes, the carbon monoxide saturation of the blood had fallen to half its value. The result obtained can be explained by the direct influence of the ultraviolet rays on the combination of hemoglobin with carbon monoxide. Besides, an important part is devolved upon the changes occurring in the system through irradiation as the causative agent of a shift of the acid-base equilibrium of the system and the consecutive alterations of metabolism.

Aus der Praxis des Elektrischen Operierens. (An Evaluation of Electrosurgery).

Klinische Wochenschr., 9:725 (April) 1930.

The report is based on the experiences gathered from 250 cases. Electrocutting, if performed on a moderate scale, is very useful in a number of operations. The hemostatic action of electrocoagulation on operation of the brain has proved excellent. Cancer of the breast has become the most favored field of this novel tissue dissection. Outstanding work can also be performed with it in surgery of the chest, especially in cases of rib resection and thoracoplasty even in the presence of pulmonary tuberculosis or empyemic cavities. This procedure also proves useful for dissecting of pulmonary tissue when lung abscesses or large bronchietases are searched for. In abdominal surgery the author warns against the use of the electric knife for longitudinal incisions in the midline; and prefers making a paramedian incision with the scalpel. In transverse dissection of bulky muscles of the abdomen, however, the hemostatic action of the electric knife is found to be a superior agent. In the range of abdominal surgery, itself, the division of the walls of the gastro-intestinal tube represents one of the greatest advances realized by the electric knife. Electrical cutting effect on the large parenchymatous organs of the peritoneal cavity has been found to be highly serviceable. With the aid of the electric knife an artificial anus can be quickly made. In spite of all these advantages the author sounds a note of warning against the specious facility of the novel procedure, for its very facility contains the danger of underrating the difficulties of many operations and the permanent value of orthodox surgery.

The Need of More Conservative Roentgen Dosage in Skin Disease. W. F. Spiller.

Tex. State Jour. Med., 26:582 (December) 1930.

Many complications and untoward effects have been noted to follow improper and poorly regulated X-ray treatments. The author cites some case reports to substantiate his contention and his plea for a more conservative regulation of dosage in roentgen treatment of skin disease. In order to avoid bad results the author advocates:

1. "That roentgen therapy be deferred until an accurate diagnosis has been made, and other methods of treatment have been given due consideration.

2. "That the least amount of X-rays necessary for a good end-result be used.

3. "That if a case does not respond fairly well to X-rays, it is better to use some other form of treatment than to risk the danger of overdosage.

4. "That it is better not to use X-rays at all than to cause a radiodermatitis which is much worse than the primary condition."

The following conclusions are advanced:

It is evident that roentgen therapy can be misused, and the sooner this misuse is corrected the better the public will feel regarding X-ray treatment, and there will be no fear when such treatment is indicated and advised.

"The average individual is often difficult to convince and, in many instances, will wrongfully interpret what his physician tells him. Until we can prove to the patient that there is a method for using X-ray that is safe, we will doubtlessly meet with many difficulties and disagreeable circumstances."

Stand Und Ausblicke Der Grenzstrahlentherapye. (Status and outlook of the borderline ray therapy). Gustav Bucky.

Medizin. Klinik. **25–30:***1119 (July) 1929.*

Borderline rays are electromagnetic oscillations of a wave length which in the linear spectrum join the usual wave length of x-rays in a direct way, thus very closely approaching x-rays in the physical sense. Bucky has proposed individual names for these rays for three reasons. The first reason was the fact that the action of this radiation causes particular biological phenomena not at all identical with those produced by ultraviolet rays. The second reason is the fact that the biological action is in general not by any means a regular function of the wave length, but that biological phenomena occur under certain circumstances asymptomatically as steeply ascending and descending reaction curves in the total spectrum of the electromagnetic oscillations. The third reason lies in the special technic this kind of rays require. The name borderline rays indicates that they lie near the limit of the routine roentgen ray wave lengths. The physical properties of the borderline rays are characterized by its obedience to all the laws commanding roentgen rays. They are distinguished from the x-rays by their great wave length and consequently small penetration power and are absorbed by superficial layers. In clinico-biological respect the borderline rays occupy a medium position between ultra-violet rays and x-rays. After irradiation by borderline rays there is never any depilation. The latent period elapsing 'till the appearance of erythema is distinctly and considerably shortened in borderline irradiation. Pigmentation following borderline irradiation is more marked than it is in x-raying and weaker than in light treatment. Cumulative effects of the doses are materially smaller than in x-ray irradiation. Resulting epithelial losses are healed in a short time. Of great importance is also the large margin of safety of the borderline rays, i.e., the distance between the curative and dangerous doses is great. Borderline rays are therefore by far less dangerous than roentgen rays.

Borderline rays are not only a valuable remedy in dermatology, but also in various other diseases, where the vegetative nervous system is involved, since the skin cannot be looked upon as a mechanical coat exclusively charged with the regulation of body temperature, the skin probably having also endocrine functions. It is also certain that part of the radiant energy is converted into nerve stimulation, an action which should explain its influence on internal diseases. This assumption is supported by the phenomenon of the immediate drop in the total white blood cell count (by from 20 to 30 per cent in the course of a quarter of an hour following a definite irritation of the skin, the original amount of leucocytes being reached again in the course of half an hour). This immediate drop in the white blood cell count is, of course, caused by the vegetative nervous system. Based on this observation Bucky has also treated cases of gastric and intestinal ulcers with very favorable results. In polycythemia rubra better results are to be obtained by borderline ray irradiation than by x-rays when the skin and not the spleen is irradiated but the much larger skin area over the long bones. Favorable effects were also obtained in spastic constipation, angina pectoris and the chronic cough of children, in which despite most careful investigations a clinical finding could never be ascertained. After a few irradiations this irritating symptom disappears. Endocrine affections are also apt to be favorably influenced; arthritis due to endocrine disturbances in women near the menopause reacts particularly well. Bucky saw very good results in oligo-amenorrhea, and good results were also obtained in hypertrichosis on endocrine basis. Borderline ray treatment proved a failure in Graves' disease by aggravating the symptoms.

Diathermy in Myelitis. W. Österreicher.

Klin. Wochen, 9:1770 (September 20), 1930.

Because other authors had observed that poliomyelitis and other chronic cerebral and spinal diseases could be influenced by diathermy, Österreicher attempted diathermy treatment of the spinal cord in a case of sporadic myelitis. He employed a strip electrode that covered the cervical, the thoracic and the upper lumbar vertebrate. A large plate electrode was placed on the abdomen. The intensity of the current was 0.7 ampere, and the first treatment lasted ten minutes. The time was gradually increased to thirty minutes. The treatment was repeated three times a week. After the third diathermic heat application the patient already showed considerable improvement. After five months the recovery was nearly complete. This favorable result induced the author to institute diathermy treatment in two other patients with myelitis. In these cases he likewise observed a remission of the paralysis and of other neurologic symptoms, and the pathologic changes in the cerebrospinal fluid disappeared. Further investigation of this therapeutic method is recommended.—Ab. *Jour. A. M. A.* 95:1785, (Dec. 6) 1930.

The Treatment of Carcinoma of the Bladder by Surgical Diathermy. Herman H. Kretchmer.
Jour. A. M. A., 95:1728 (December 6), 1930.

The author has reported his experiences with surgical diathermy in a series of 109 unselected cases. In evaluating any therapeutic agent Kretchmer has thought "it is absolutely necessary that two conditions be fulfilled:

1. "It should be the only agent used, since the use of more than one agent only serves to complicate the problem of determining to what extent each of the agents used was responsible for the recovery of the patient.

2. "In order to determine accurately the value of surgical diathermy, it is necessary that all cases, 'early as well as late,' be treated with the particular agent under consideration. To reserve the early cases for resection and to use diathermy only in the far advanced and hopeless cases evidently is not giving this therapeutic agent an 'even break'."

He summarizes his observations as follows:

1. "A group of 109 unselected cases of carcinoma of the bladder were studied.

2. "All of the cases were treated with a single agent, namely, surgical diathermy.

3. "In seventy cases, or practically two thirds of the cases seen, the condition was far advanced and the results from the standpoint of cure were highly unsatisfactory and the mortality rate was high.

4. "In twenty-three cases seen, relatively early, without much involvement of the bladder wall, the results were unusually good."

Zur Indirekten Roentgenbehandlung Des Ekzems. (Indirect roentgen ray treatment of eczema). C. Kreibich.
Dermatol. Wochenschr. **91**:*1198, (Aug.) 1930.*

Considering eczema as a cutaneous reaction the pathological origin of which depends on the nervous system, the author succeeded in favorably influencing chronic cases of eczemas and neurodermitides by indirectly irradiating the spinal cord. Cross-fire irradiation of the dorsal and lumbar cords (according to the location of the affection) or irradiation at full length on both sides of the spine was instituted on four fields each. With an inclination of 45 degrees of the tube, each field receives ⅓ S.U.D. of hard rays, filtered by 0,5 Zn, plus 1 mm. Al. The irradiation is repeated 2 or 3 times at two week intervals. The effect manifested itself chiefly in regard to the sensory component by relief of itching; which in turn lessened conscious and unconscious chafing, thus leading to an improvement of the exudative phenomena.

The Treatment of Bladder Carcinoma by Irradiation and Diathermy. G. G. Smith.
Jour. A. M. A., 95:1730 (December 6), 1930.

For purposes of comparison of the effectiveness of both agents (Irradiation and Diathermy) the author has here included his experiences by excision. Of the fifty cases that were thus studied, eleven were treated by excision, fifteen by electrocoagulation and twenty-four by implantation with radium. Nine cases of the last group were treated by coagulation prior to implantation of radium, but have been included under the group of irradiation because they were studied for their results on a basis of irradiation. The author has summarized his observations under the following conclusions:

1. "This study is based on fifty cases of carcinoma of the bladder, of which eleven were treated by excision, fifteen by electrocoagulation and twenty-four by irradiation.

2. "Operative mortality was lowest in the cases treated by diathermy, but deaths from recurrences were slightly greater in this group.

3. "No one method is suitable for all cases. Deeply infiltrating carcinomas are best treated by excision or irradiation, depending on their location. Superficial papillary growths should be destroyed by electrocoagulation, and the bases, if indurated, should be irradiated.

4. "With all of these methods, successful results were obtained in one out of every four (25 per cent)."

Radium in Superficial Face Lesions. A. W. Chernosky.
Tex. State Jour. Med., 26:573 (December) 1930.

The treatment of superficial lesions of the face with radium has made rapid progress in recent years. It has many advantages over other known methods of treatments in that exact dosage can be introduced, since the quantity of radium remains the same. Experience and judgment is essential in its proper use, otherwise there will result great harm and failure. The author draws the following conclusions from his wide experience:

1. In early superficial lesions radium gives good results with minimum scarring.

2. The application of radium encourages the sufferer to apply for early treatment, since the application, when properly used, and in sufficient amount, is harmless and painless.

3. Unless the lesion is very extensive the patient may pursue his daily duties while receiving the treatment.

4. If the radium treatment is unsuccessful, surgical measures may be resorted to without detriment to the patient.

5. By combining radium treatment and surgery we can increase the percentage of operable cases, and, by the use of radium radiation as an after-treatment, we can reduce the number of recurrences of malignancy.

Wege Zur Steigerung Und Verminderung Der Milchsekretion Im Wochenbett. (Ways and means of increasing and diminishing milk secretion during puerperium). Michael Wachtel.
Ztbl. f. Gynäkol., 53:987 (April) 1929.

Undisturbed activity of the mammary glands is most important for mother and child during puerperium and afterwards. Owing to the failure of the galactogogues many mothers have had to resort to artificial nourishment, which cannot fully replace breast feeding. The author has applied artificial sunlight with great success in cases of diminished milk secretion; the results were also excellent in cases of early diminution in the quantity of the milk. Both breasts were irradiated for 3 minutes for the first 10 or 12 days, then with a daily increase of 3 minutes up to 30-35 minutes. The dis-

tance of the source of light was 70-75 cm.; after two weeks the irradiation was administered every second or third day. The regular, simultaneous use of heating from a series of incandescent lamps was a requisite part of the procedure. Evacuation of the breast prior to treatment is an essential of the treatment. This should be accomplished by either suckling, squeezing or pumping. Previous to each exposure and for the sake of their protection, the nipples are covered with boric petrolatum. The increase of milk secretion is demonstrated in the majority of cases within 6 to 8 days. In case of red-haired women caution is to be observed on account of danger of burning.

Zur Physik Und Physiologie Der Wirkung Von Gasbaedern. I, Die Wirkung Von Feinblasigen Sauerstoff-Baedern Auf Die Haut. (Physics and physiology of the effects of gas baths. I. The effect of small foam oxygen baths on the skin). R. W. Schulte.

Zeitschrift für die ges. phys. Ther., 37:99 (September) 1929.

This article deals with experiments inquiring into the balneological effect of minute foam oxygen bath, according to the method of Bergmann. The fundamental ingredients of Bergmann's bath consist of a particularly intensely dried out perborate, chemically adjusted to a highly alkaline non-developing catalyst into whose composition has been introduced traces of various metal salts. The development of oxygen in these baths is recognized by their pearliness, and is prolonged in action. Soon after entering the bath the whole of the skin, the lanugo hair, etc., is covered over with the finest of bubbles, gathered in a layer as thin as cobweb. The activity of the oxygen is perceptible for more than half an hour.

The effect of the oxygen bubbles on the skin seems to be a double one. The physiologically greater effect is to be ascribed to a fine, mechanical vibration massage of the upper layer of the skin, due to the continuous activity of the nascent oxygen. There are also chemical processes which come into play. We can assume that the pre-existing alkaline reaction of the colloid substances of the tissue strongly favors the avidity of the oxygen for oxidizing effects. The surface action on the skin is essentially increased, due to the fine percussion of the friction from the oxygen bubbles. A distinct smoothing effect of the skin generally occurs after alkaline baths. The oxydative processes of oxygen baths seems to produce a relaxing action of the uppermost horny layers of the epidermis.

Schulte is of the opinion that the general effect of baths is to be explained not only by the local, primary influence on the skin but also by the irradiation of the endings of the cutaneous nerves as well as by the change of the filling condition of the fine cutaneous vessels and by a reflex effect on the central nervous system, the respiration and the circulation. Certainly the specific delicate massage of the skin outside of the rather chemical, i. e., oxydative action on it, plays a conspicuous part in the stimulation of the physiological, therapeutic and possibly, psychological effects. Gas baths act clinically in quite another way as compared to ordinary, saline or electrical baths of different temperature. It would appear that the skin which is a regulating organ for many somatic processes, is endowed with a reflex nervous system as yet little known but, nevertheless, plays a part therein. One must also bear in mind hormonal substances of the skin. That osmotic activities also play a part in the foregoing processes, is more than probable in consideration of the fact that the interior of the body undergoes a constant strong pressure of seven atmospheres or so, thereby impressing on it and the whole of the skin a certain elastic external tension.

The preparation of Bergmann's oxygen baths to enforce catalytic processes by virtue of its oxygen content, is of great interest. Finely dispersed metals have the power of seizing upon and again giving off countless gas molecules, upon which fact rests the catalytic effect of the iron finely spread in the blood. Whether this chemical catalytic agent produces a favorable adjuvant effect on or in the skin, is a question whose appreciation is only of hypothetical importance.

Ueber Den Wert Der Atmosphaerischen Kuren In Den Gradierwerken. (The value of atmospheric cures in graduation houses). F. Krone.

Ztschr. f. wissenschft. Bäderkde., 4:1137 (September) 1930.

The physiologic effect of the air in graduation houses is influenced by the refreshing coolness inherent to evaporation and consists in an increase in stimulation of the respiratory center as compared with breathing in common air. The more intense the stimulation of the respiratory center, the more efficient is the function of the respiratory organs and the larger the amount of oxygen absorbed and carbonic acid given off by the lungs. The larger, however, the absorption of oxygen, the more active the circulation of blood in the vessels and the oxydation of hemoglobin of the red corpuscles of the blood. The reabsorbing influence of the air in graduation houses comes into play already in the upper air passages in that the increased combustion in the tissues is concomitant to the decongestion of the diseased mucous membranes associated with exaggerated excretion of the toxic products. In addition to the refreshing coolness in these chambers, the curative action is due to the air remaining pure in the wet, salt impregnated air in these places, and to the amount of various minerals of the air. Atmospheric cures in graduation houses served the author best in most of the toxic conditions where salt baths are indicated. The author found them of special value in bronchial asthma which he did not consider as a decrease in many cases but just a manifestation of the vegetative nervous system of hypersensitive individuals. These favorable results were thought to be due to the removal of the catarrhal symptoms of the asthma in patient by the inhalation of air in the graduation houses, and to the removal of the fear of catching cold. It would seem that there is evidence of the beneficial action of inhalation in graduation houses on the nervous system and respiration. Emphysematous individuals as well as short-winded patients afflicted with heart failure are benefited by these atmospheric cures.

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Of Archives of Physical Therapy, X-Ray, Radium published Monthly at Chicago, Ill., for April 1, 1931.

State of Illinois, } ss.
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Before me, a Notary Public in and for the State and county aforesaid, personally appeared Disraeli Kobak, M.D., who, having been duly sworn according to law, deposes and says that he is the Editor of the Archives of Physical Therapy, X-Ray, Radium and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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